

THE COLLECTED WORKS OF

ALDOUS HUXLEY

Literature and Science
Science, Liberty and Peace

"Questions of the day rarely have an elucidator of the imaginative simplicity and assured authority of Mr. Huxley. No one with any interest in the implication of cultural ideas, as reflected from the resonant scientific background of contemporary life, should miss this book."

QUARTERLY REVIEW

Here are two important essays dealing with the special problems of a scientific age. *Literature and Science* is Aldous Huxley's contribution to the 'Two Cultures' debate; it displays the clarity of a scientific mind and the sensitivity of a literary imagination. When it was first published in 1963, John Raymond commented on 'the writer's wit, the speed and turn of his ideas, and the heap of learning, literary and scientific, that he deploys with such a masterful address'.

Science, Liberty and Peace argues that technological progress has been used to concentrate economic and political power in the hands of a ruling minority, not to benefit society in general; the main remedy suggested is the decentralisation of power and property. Described by Joseph Taggart as a 'bitter, acute and brilliantly-written exposé', this is a powerful plea for the humanistic application of scientific knowledge; its thesis is even more important for the seventies than for the time when it was written.

Jacket design by John Woodcock

£1.25p

ISBN 0 7011 1690 0

25s net

THE COLLECTED WORKS OF ALDOUS HUXLEY



LITERATURE AND SCIENCE
and
SCIENCE, LIBERTY AND PEACE

By *ALDOUS HUXLEY*

Novels

GROME YELLOW
ANTIC HAY
THOSE BARREN LEAVES
POINT COUNTER POINT
BRAVE NEW WORLD
BRAVE NEW WORLD REVISITED
EYELESS IN GAZA
AFTER MANY A SUMMER
TIME MUST HAVE A STOP
APE AND ESSENCE
THE GENIUS AND THE GODDESS
ISLAND

Short Stories

LIMBO
MORTAL COILS
LITTLE MEXICAN
TWO OR THREE GRACES
BRIEF CANDLES
COLLECTED SHORT STORIES

Biography

GREY EMINENCE
THE DEVILS OF LOUDUN

Essays and Belles Lettres

ON THE MARGIN
ALONG THE ROAD
PROPER STUDIES
DO WHAT YOU WILL
MUSIC AT NIGHT &
VULGARITY IN LITERATURE
TEXTS AND PRETEXTS (Anthology)
THE OLIVE TREE
ENDS AND MEANS (An Enquiry
into the Nature of Ideals)
THE ART OF SEEING
THEMES AND VARIATIONS
THE PERENNIAL PHILOSOPHY
SCIENCE, LIBERTY AND PEACE
THE DOORS OF PERCEPTION
HEAVEN AND HELL
ADONIS AND THE ALPHABET
COLLECTED ESSAYS
LITERATURE AND SCIENCE

Travel

JESTING PILATE
BEYOND THE MEXIQUE BAY
BEYOND THE MEXIQUE BAY (Illustrated)

Poetry and Drama

VERSES AND A COMEDY
(including early poems, Leda, The Cicadas
and The World of Light, a Comedy)
THE GIOCONDA SMILE

For Children

THE CROWS OF PEARBLOSSOM
LETTERS OF ALDOUS HUXLEY

LITERATURE AND SCIENCE
and
SCIENCE, LIBERTY
AND PEACE

By
ALDOUS HUXLEY



Book supplied by the Madurai University
Central Co op. Stores. Madurai-2.

1970

CHATTO & WINDUS

LONDON

PUBLISHED BY
Chatto & Windus
LONDON



Clarke, Irwin & Co. Ltd.
TORONTO

ISBN 0 7011 1690 0

Literature and Science was first published in 1963.

Science, Liberty and Peace was first published
in 1947 and reprinted in 1950.

The two titles were reissued in this edition in 1970.

62562

O:6 M944x
LO

Applications regarding translation rights in any
work by Aldous Huxley should be addressed to
Chatto & Windus, 40 William IV Street, London,
W.C.2

*All rights reserved. No part of this publication may
be reproduced, or stored in a retrieval system, or
transmitted in any form, or by any means, electronic,
mechanical, photocopying, recording or otherwise, with-
out the prior permission of Chatto & Windus Ltd.*

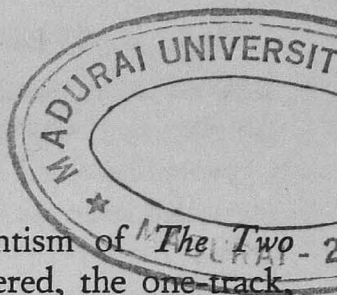
© *Literature and Science* Mrs. Laura Huxley 1963

© *Science, Liberty and Peace*

Mrs. Laura Huxley 1947

Printed in Great Britain by
Lewis Reprints Limited, Port Talbot,
Glamorgan

LITERATURE AND SCIENCE



I

SNOW or Leavis? The bland scientism of *The Two Cultures* or, violent and ill-mannered, the one-track, moralistic literarism of the Richmond Lecture? If there were no other choice, we should indeed be badly off. But happily there are middle roads, there is a more realistic approach to the subject than was made by either of the two champions. And the two champions, let us remember, are not the only combatants in the field; they are merely, at this moment, the most notorious. The field has known a long succession of fighters for this cause or for that, a long succession, too, of earnest compromisers anxiously trying to negotiate a fruitful peace between the opposing forces, or at least a not too hostile symbiosis. One thinks of T. H. Huxley, with his advocacy of a primarily scientific education tempered (as Caltech, for example, and M.I.T. now temper it) with plenty of history, sociology, English literature and foreign languages. One thinks of Matthew Arnold, pleading for a primarily humanistic and specifically classical education, tempered by enough science to make its recipients understand the singularly un-Hellenic world in which they find themselves living. Huxley would most certainly have agreed with Arnold in thinking that man, and even man's remote ancestor, 'the hairy quadruped furnished with a tail and pointed ears, probably arboreal in his habits . . . carried hidden in his nature something destined to develop into a necessity for humane letters'. He refused, however, to accept 'the further conclusion that our hairy ancestor carried in his nature, also, a necessity for Greek', and would have

LITERATURE AND SCIENCE

maintained instead, that this other spiritual necessity was for the methods and results of science.

Since the time, eighty years ago, of that famous argument between the chief representative of what Huxley called 'the Levites of culture' and the chief representative of 'what the poor humanist is sometimes apt to regard as its Nebuchadnezzars', much has been written on the themes of science versus humane letters, of science *and* humane letters. The most recent contributions to the argument have come from Professor Lionel Trilling and Dr Robert Oppenheimer. In an admirably judicious essay, published in the June 1962 issue of *Commentary*, Professor Trilling sums up the Leavis-Snow controversy and talks with subtlety and good sense about the relations between science, literature, culture and Mind. Dr Oppenheimer's paper, 'Science and Culture' appeared in *Encounter* for October 1962. It is a sound, but not particularly original essay; for in somewhat woollier language it says, more or less, what Eddington was saying in the thirties—what, indeed, any intelligent physicist, who also cares for the arts, has a private life and feels a concern for the public weal, can hardly fail to say. Unfortunately, like Professor Trilling's, these reflections upon science and culture are too abstract and general to be very enlightening. In the paragraphs that follow, I shall attempt to deal with this much-discussed theme in terms more concrete than those employed by Oppenheimer and Trilling, by Leavis, Snow and the Victorian initiators of the great debate. What is the function of literature, what its psychology, what the nature of literary language? And how do its function, psychology and language differ from the function, psychology and language of science? What, in the past, has been the relationship between literature and

LITERATURE AND SCIENCE

science? What is it now? What might it be in the future? What would it be profitable, artistically speaking, for a twentieth-century man of letters to do about twentieth-century science? These are the questions I shall try to answer.

2

All our experiences are strictly private; but some experiences are less private than others. They are less private in the sense that, under similar conditions, most normal people will have similar experiences and, having had them, can be relied upon to interpret the spoken or written reports of such experiences in much the same way.

About the more private of our experiences no such statements can be made. For example, the visual, auditory and olfactory experiences of a group of people watching the burning of a house are likely to be similar. Similar, too, are the intellectual experiences of those members of the group who make the effort to think logically about the causes of this particular fire and, in the light of current knowledge, of combustion in general. In other words, sense impressions and the processes of rational thought are experiences whose privacy is not too extreme to make them unshareable. But now let us consider the emotional experiences of our fire-watchers. One member of the group may feel sexual excitement, another aesthetic pleasure, another horror, and yet others human sympathy or inhuman and malicious glee. Such experiences, it is obvious, are radically unlike one another. In this sense they are more private than sense experiences and the intellectual experiences of logical thought.

In the present context, science may be defined as a device for investigating, ordering and communicating the

LITERATURE AND SCIENCE

more public of human experiences. Less systematically, literature also deals with such public experiences. Its main concern, however, is with man's more private experiences, and with the interactions between the private worlds of sentient, self-conscious individuals and the public universes of 'objective reality', logic, social conventions and the accumulated information currently available.

3

The man of science observes his own and the reports of other people's more public experiences; conceptualizes them in terms of some language, verbal or mathematical, common to the members of his cultural group; correlates these concepts in a logically coherent system; then looks for 'operational definitions' of his concepts in the world of nature, and tries to prove, by observation and experiment, that his logical conclusions correspond to certain aspects of events taking place 'out there'.

In his own way, the man of letters is also an observer, organizer and communicator of his own and other people's more public experiences of events taking place in the worlds of nature, culture and language. Viewed in a certain way, such experiences constitute the raw material of many branches of science. They are also the raw material of much poetry, many dramas, novels and essays. But whereas the man of science does his best to ignore the worlds revealed by his own and other people's more private experiences, the man of letters never confines himself for long to what is merely public. With him, outer reality is constantly related to the inner world of private experience, shared logic modulates into unshareable feeling, wild individuality is forever breaking through the crust of

LITERATURE AND SCIENCE

cultural custom. Moreover the way in which the literary artist treats his subject matter is very different from the way in which the same subject matter is treated by the man of science. The scientist examines a number of particular cases, notes all similarities and uniformities and from these abstracts a generalization, in the light of which (after it has been tested against the observed facts) all other analogous cases may be understood and dealt with. His primary concern is not with the concreteness of some unique event, but the abstracted generalizations, in terms of which all events of a given class 'make sense'. The literary artist's approach to experience—even to experience of the more public kind—is very different. Repeatable experiments and the abstraction from experience of utilizable generalizations are not his business. His method is to concentrate upon some individual case, to look into it so intently that finally he is enabled to look clean through it. Every concrete particular, public or private, is a window opening on to the universal. *King Lear*, *Hamlet*, *Macbeth*—three grisly anecdotes, about highly individualized human beings in exceptional situations. But through these records of unique and extremely improbable events occurring simultaneously in the worlds of private and public experience, Shakespeare saw, and miraculously made it possible for us to see, enlightening truth on every level from the theatrical to the cosmic, from the political to the sentimental and the physiological, from the all too familiarly human to the divinely unknowable.

The physical sciences started to make progress when investigators shifted their attention from qualities to quantities, from the appearances of things perceived as wholes to their fine structures; from the phenomena presented to consciousness by the senses to their invisible

LITERATURE AND SCIENCE

and intangible components, whose existence could only be inferred by analytical reason. The physical sciences are 'nomothetic'; they seek to establish explanatory laws, and these laws are most useful and enlightening when they deal with relationships between the invisibles and intangibles underlying appearances. These invisibles and intangibles cannot be described, for they are not objects of immediate experience; they are known only by inferences drawn from immediate experiences on the level of ordinary appearance. Literature is not 'nomothetic', but 'idiographic'; its concern is not with regularities and explanatory laws, but with descriptions of appearances and the discerned qualities of objects perceived as wholes, with judgments, comparisons and discriminations, with 'in-scapes' and essences, and finally with the *Istigkeit* of things, the Not-thought in thoughts, the timeless Suchness in an infinity of perpetual perishings and perpetual renewals.

The world with which literature deals is the world into which human beings are born and live and finally die; the world in which they love and hate, in which they experience triumph and humiliation, hope and despair; the world of sufferings and enjoyments, of madness and common sense, of silliness, cunning and wisdom; the world of social pressures and individual impulses, of reason against passion, of instincts and conventions, of shared language and unshareable feeling and sensation; of innate differences and the rules, the roles, the solemn or absurd rituals imposed by the prevailing culture. Every human being is aware of this multifarious world and knows (rather confusedly in most cases) where he stands in relation to it. Moreover, and, by analogy with himself, he can guess where other people stand, what they feel and how they

LITERATURE AND SCIENCE

are likely to behave. As a private individual, the scientist inhabits the many-faceted world in which the rest of the human race does its living and dying. But as a professional chemist, say, a professional physicist or physiologist, he is the inhabitant of a radically different universe—not the universe of given appearances but the world of inferred fine structures, not the experienced world of unique events and diverse qualities, but the world of quantified regularities. Knowledge is power and, by a seeming paradox, it is through their knowledge of what happens in this unexperienced world of abstractions and inferences that scientists and technologists have acquired their enormous and growing power to control, direct and modify the world of manifold appearances in which human beings are privileged and condemned to live.

Every science has its own frame of reference. The data of physics are co-ordinated in one way, the data of ornithology (a science that is as yet a good deal more idio-graphic than nomothetic) are co-ordinated in another, very different way. For Science in its totality, the ultimate goal is the creation of a monistic system in which—on the symbolic level and in terms of the inferred components of invisibly and intangibly fine structure—the world's enormous multiplicity is reduced to something like unity, and the endless succession of unique events of a great many different kinds gets tidied and simplified into a single rational order. Whether this goal will ever be reached remains to be seen. Meanwhile we have the various sciences, each with its own system of co-ordinating concepts, its own criterion of explanation.

The man of letters, when he is being most distinctively literary, accepts the uniqueness of events, accepts the diversity and manifoldness of the world, accepts the

LITERATURE AND SCIENCE

radical incomprehensibility, on its own level, of raw, un-conceptualized existence and finally accepts the challenge which uniqueness, multifariousness and mystery fling in his face and, having accepted it, addresses himself to the paradoxical task of rendering the randomness and shapelessness of individual existence in highly organized and meaningful works of art.

4

There exists in every language a rough and ready vocabulary for the expression and communication of the individual's more private experiences. Anyone capable of speech can say, 'I'm frightened', or 'How pretty!', and those who hear the words will have a crude but, for most practical purposes, a sufficiently vivid idea of what is being talked about. Bad literature (bad, that is to say, on the private level—for, as quasi-science and in relation to man's more public experience, it may be quite good), bad literature hardly goes beyond the *how pretty's* and *I'm frightened's* of average everyday speech. In good literature—good, that is to say, on the private level—the blunt imprecisions of conventional language give place to subtler and more penetrating forms of expression. The ambition of the literary artist is to speak about the ineffable, to communicate in words what words were never intended to convey. For all words are abstractions and stand for those aspects of a given class of experiences which are recognizably similar. The elements of experience which are unique, aberrant, other-than-average, remain outside the pale of common language. But it is precisely these elements of man's more private experiences that the literary artist aspires to communicate. For this purpose common language is wholly inadequate.

LITERATURE AND SCIENCE

Every literary artist must therefore invent or borrow some kind of uncommon language capable of expressing, at least partially, those experiences which the vocabulary and syntax of ordinary speech so manifestly fail to convey. *Donner un sens plus pur aux mots de la tribu*—that is the task confronting every serious writer; for it is only by an unusual combination of purified words that our more private experiences in all their subtlety, their many-faceted richness, their unrepeatable uniqueness can be, in some sort, re-created on the symbolic level and so made public and communicable. And even so, even at the best, how hopeless is the writer's task!

They are the smallest pieces of the mind
That pass the narrow organ of the voice;
The great remain behind in that vast orb
Of the apprehension, and are never born.

In paradise the saints experience a bliss *che non gustata non s'intende mai*. And the same is true of the ecstasies and pains of human beings here on earth. Untasted, they can never be comprehended. In spite of 'all the pens that ever poets held'—yes, and in spite of all the scientists' electron microscopes, cyclotrons and computers—the rest is silence, the rest is always silence.

5

As a medium of literary expression, common language is inadequate. It is no less inadequate as a medium of scientific expression. Like the man of letters, the scientist finds it necessary to 'give a purer sense to the words of the tribe'. But the purity of scientific language is not the same as the purity of literary language. The aim of the scientist

LITERATURE AND SCIENCE

is to say only one thing at a time, and to say it unambiguously and with the greatest possible clarity. To achieve this, he simplifies and jargonizes. In other words, he uses the vocabulary and syntax of common speech in such a way that each phrase is susceptible of only one interpretation; and when the vocabulary and syntax of common speech are too imprecise for his purposes, he invents a new technical language, or jargon, specifically designed to express the limited meaning with which he is professionally concerned. At its most perfectly pure, scientific language ceases to be a matter of words and turns into mathematics.

The literary artist purifies the language of the tribe in a radically different way. The scientist's aim, as we have seen, is to say one thing, and only one thing, at a time. This, most emphatically, is not the aim of the literary artist. Human life is lived simultaneously on many levels and has many meanings. Literature is a device for reporting the multifarious facts and expressing their various significances. When the literary artist undertakes to give a purer sense to the words of his tribe, he does so with the express purpose of creating a language capable of conveying, not the single meaning of some particular science, but the multiple significance of human experience, on its most private as well as on its more public levels. He purifies, not by simplifying and jargonizing, but by deepening and extending, by enriching with allusive harmonics, with overtones of association and undertones of sonorous magic.

What is a rose? A daffodil? A lily? One set of answers to these questions may be given in the highly purified languages of bio-chemistry, cytology and genetics. 'A special form of ribonucleic acid (called messenger RNA)

LITERATURE AND SCIENCE

carries the genetic message from the gene, which is located in the nucleus of the cell, to the surrounding cytoplasm, where many of the proteins are synthesized'. And so on in endless, fascinating detail. A rose is a rose is a rose, is RNA, DNA, polypeptide chains of amino acids. . . .

And here, on a considerably lower level of scientific purification, are the perfunctory botanical answers to our questions, provided by an encyclopaedia in its articles *Rose* and *Daffodil*. 'The carpels of the rose are concealed within the receptacular tube and only the stigmas as a rule project from its mouth. . . . By repeated radial and tangential branching a vast number of stamens are produced. . . . Under natural circumstances rose flowers do not secrete honey, the attraction for insects being provided by the colour and perfume and the abundance of pollen for food. . . . Conserve of dog rose is made from the ripe hips of *Rosa canina*. Its only use is in the manufacture of pills'. As for *Narcissus Pseudo-Narcissus*, 'Its flowers are large, yellow, scented and a little drooping, with a corolla deeply cleft into six lobes, and a central bell-shaped nectary, which is crisped at the margin. . . . The stamens are shorter than the cup, the anthers oblong and converging; the ovary is globose and has three furrows. . . . The bulbs are large and orbicular; they, as well as the flowers, are reputed to be emetic in properties.'

The primary interest of the literary artist is not in cells or genes or chemical compounds, not in the orbicularity of bulbs or the number of stamens, not even in the manufacture of pills or the concoction of herbal emetics. His concern is with his own and other people's more private experiences in relation to flowers and with the multiple meanings he finds in them. He is a man, and men must

LITERATURE AND SCIENCE

sweat for a living; so he considers the blessed lilies that toil not, neither do they spin. He is often depressed by too much thinking, or bored by too little; but, thank heaven, remembered daffodils flash upon that inward eye which is the bliss of solitude. 'A poet could not but be gay:' but alas, those brave flowers 'that come before the swallow dares, and take the winds of March with beauty'—how quickly they fade! The poet weeps to see them haste away so soon; weeps over time flying and approaching death and the loss of those he loves. *Et rose elle a vescu ce que vivent les roses, L'espace d'un matin.* And there is also the misguided idealist who weeps over *la metempsychose des lys en roses*. There is the unashamed sensualist who luxuriates in the thought of *la mousse où le bouton de rose brille*. There is the religious contemplative, alternately consoled and desolated, whose shrivelled heart, in a moment of dryness, 'goes quite under ground, as flowers depart', when their blossoming is over, to 'keep house with their mother root'—or, if you prefer the other kind of purified language, their orbicular bulb. And sometimes the lilies fester so that those rotting symbols of virginity come to smell worse than weeds. Sometimes, too, it is the rose that is sick; for the invisible worm 'has found out thy bed of crimson joy, and his secret love does thy life destroy'. But sometimes, miraculously, when the doors of perception have been cleansed, we find ourselves seeing a Heaven in a Wild Flower and holding Infinity in the palm of our hand. Sometimes, weary of time, the broad sunflower breaks out of the dark Tennysonian garden where it hangs so heavily over its own grave and comes to new apocalyptic life in that golden Eternity 'where the traveller's journey is done'. Very nice! comments the botanist, and proceeds to inform us that 'the genus *Helianthus*

LITERATURE AND SCIENCE

contains about fifty species, chiefly natives of North America, a few being found in Peru and Chile. In parts of England', he adds, 'hundreds of plants are grown for their seeds on sewage farms'.

6

The way in which scientists purify the words of their tribe requires no further illustration. From science to science technical jargons vary, of course, enormously. But the principles underlying jargonization, and the reasons for it, are always the same. So are the reasons for systematic simplification and the principle which decrees that every sentence in a scientific exposition shall say one thing, and one thing only, at a time.

In the works of literary art, as we have seen, common speech is treated to a very different kind of purification. Eschewing technical jargon, the man of letters takes the words of the tribe and, by a process of selection and novel arrangement, transforms them into another, purer language—a language in which it is possible to communicate unshareably private experiences, to give utterance to the ineffable, to express, directly or by implication, the diverse qualities and meanings of existence in the many universes—cosmic and cultural, inward and outward, given and symbolical—within which human beings are predestined, by their multiple amphibiousness, to live and move and have their bewildered being. Many, subtle, sometimes strange and extraordinary, are the ways in which the language of the tribe has been purified so as to make it capable of rendering human life in its collective fulness as well as its most intimate privacy, at its aesthetic, intellectual and spiritual heights as well as in its obscurest depths of instinct and physiology. Let us

LITERATURE AND SCIENCE

consider a few concrete examples of such linguistic purification.

7

I will begin on what may be called the macroscopic level. Here is a literary artist who wishes to express the multiple meanings of human existence in its fulness. How must he construct a narrative, say, or a drama, so as to convey these multiple meanings? One answer to this question is Shakespeare's *Troilus and Cressida*. Besides being a tragic drama, this extraordinary play is a vast repertory of life's multiple meanings. We are shown its meaning for the pathetically innocent and romantic Troilus; its meaning for Hector, the heroic idealist; for the ripe, intensely practical intelligence of Ulysses; for Helen and Cressida in their delicious universes of beauty and sexuality; for the two hulking mesomorphs, the idiot Ajax and the brighter but hardly less odious Achilles; and finally its meaning for Thersites, the man who can only hate, the universal debunker, the walking *memento mori*, for whom all flesh is excrement, syphilis and putrefaction.

War and Peace provides another answer to our question. Inward and outward, personal and collective, concrete givenness and high abstraction—all the meanings of existence emerge as the novel's many characters live their lives and die their deaths, and as Tolstoy himself comments philosophically on the great historical movements in which they find themselves involved.

The possibility of shifting from objectivity to life's subjective meanings is built into the structure of almost every good novel. What a character does is described, now from the outside, now from within, now as others see the event and now as the protagonist feels it. Or con-

sider the unshareableness of private experience. In a fictional narrative this is rendered by the juxtaposition of two parallel inwardnesses, or else of an inwardness and some simultaneous, but unconnected and irrelevant objectivity. One thinks, for example, of Emma Bovary after the love-making in the wood. 'Silence was everywhere; a sweetness seemed to come forth from the trees. She felt her heart, whose beating had begun again; she felt the blood coursing through her flesh like a stream of milk. Then, far away, beyond the wood, on the other hill, she heard a vague, long-drawn cry. In the silence she heard it mingling like music with the last pulsations of her nerves. Rodolphe, a cigar between his lips, was busy with his penknife, mending one of the two broken bridles'.

It should be remarked that this systematic shifting of attention from one order of experience to another is a literary device of rather recent invention. In *Moll Flanders*, for example, the narrative, although in the first person, is an account of events seen, in the main, from the outside. 'We had not sat long, but he got up, and stopping my very breath with kisses, threw me upon the bed again; but then being both well warmed, he went further with me than decency permits me to mention, nor had it been in my power to deny him in that moment, had he offered much more than he did.' About this kind of thing, there is an engaging artistic innocence. Very different is the calculated, one-track objectivity of *Candide*, from which private experience is deliberately and, so to say, flagrantly omitted for the express purpose of emphasizing the criminal stupidity, the absurd as well as hideous wickedness of human behaviour. Here is Voltaire's account of the *auto da fé* prescribed by the University of

Coimbra as a sure preventive of any repetition of the Lisbon earthquake.

'Ils marchèrent en procession ainsi vêtus, et entendirent un sermon très pathétique, suivi d'une belle musique en faux-bourdon. Candide fut fessé en cadence pendant qu'on chantait; le Biscayen et les deux hommes qui n'avaient pas voulu manger le lard furent brûlés, et Pangloss fut pendu, quoique ce ne soit pas la coutume. Le même jour la terre trembla de nouveau avec un fracas épouvantable.'

8

From purification of language on the level of structural anatomy we pass to purification on what may be called the cellular and molecular levels of the paragraph, sentence and phrase. It is mainly on these levels that the literary artist gives expression to the inexpressible and makes public the most private of experiences. Here, for example, is Emily Dickinson writing, in 'A Light Exists in Spring', about one of Nature's mysterious apocalypses and the sense of desolation that follows a moment of vision.

A colour stands abroad
On solitary hills
That science cannot overtake,
But human nature feels.

It is there, like a divine revelation; then abruptly, 'without the formula of sound, it passes, and we stay'.

A quality of loss
Affecting our content,
As trade had suddenly encroached
Upon a sacrament.

LITERATURE AND SCIENCE

In this case a private experience has been rendered by the evocation of some of life's multiple meanings—trade and sacrament—in the world of collective action and conceptual thought. But there are, of course, many other ways in which the literary artist can talk about the ineffable.

It is so quiet,
The cicada's voice
Penetrates
The rocks.

In this *haiku* by Basho the experience recorded is of a unique event through which the Suchness of things, the divine Ground, as Meister Eckhart would call it, breaks out of eternity into time. To communicate this indescribable event, the Japanese poet has refined his utterance to the point where it seems about to turn into the *creux néant musicien* of a silence as absolute as that which filled the spaces between the rocks and by mysterious implication (and yet how indubitably!) imparted to the mindless repetition of insect noises a kind of absoluteness, a cosmic significance.

At the other end of the world we find Andrew Marvell

Annihilating all that's made
To a green thought in a green shade.

Basho would have begun and ended there. In 'The Garden' green annihilation into green thought is only one incident among many. Marvell was working within a poetical tradition that concerned itself with a wider spectrum of life's multiple meanings than the writers of *haiku* had chosen as their domain.

At the opposite pole to the mode of expression by mysterious implication is the mode of direct expression by means of the *mot juste*. The tribe's language can be purified into expressiveness by the choice of the right noun, the perfect adjective, the supremely apt verb. For example, what does one feel when one hears good music? With two substantives and a pair of epithets, Milton provides an answer that is at once poetical and scientific in its purity: 'such sober certainty of waking bliss'. But the *mot juste* possesses only a limited usefulness. In most cases, the intimacies of our more private experience and the multiplicity of life's meanings cannot be translated directly with a one-to-one correspondence, into a single *mot juste*, or even into a single 'right' phrase or sentence. Here, to illustrate this point, are some of the words and phrases culled by Bishop Rovenius from the mystical literature of his time—the seventeenth century. *Inflaming transubstantiations; super-essential unions; absorbent enthusiasms; abyssal liquefactions; deific confrications; insupportable assaults; hypercelestial penetrations; spiritual shamelessness; meridian holocausts in a visceral and medullar penetrability*. Each of these strange locutions (my own favourite is 'deific confrications') is the product of a misguided effort on the part of some earnest and perhaps truly enlightened soul to purify the words of the tribe into a pseudo-scientific jargon of *mots justes* for classifying and communicating mystical experiences. But mystical experiences are at once too private and too enormous to be rendered by one-to-one translation into some unequivocally right and perfect phrase. If one is to talk about them at all, it must be by indirection—in terms, for

example, of such paradoxical phrases as Crashaw's 'sweetly killing dart', or the *cauterio suave, regalada llaga* of St John of the Cross, or alternatively by mixing psychological description with metaphysics and theology. Thus Suso tells us that, for mystics, there is an immediate and completely private experience of light, and that, in this light, 'the mind dies, loses its individuality and is lost in the pure and simple unity'. And when the mystic says he loves God, precisely how does he love Him? 'As not-God', says Meister Eckhart, 'not-Spirit, not-Person, not-image, but as He is, a sheer, pure, absolute One, in whom we must continually sink from nothingness to nothingness'.

IO

Hardly less enormous than the mystical union with God, and, although shared, hardly less unspeakably private, is the cognate experience of sexual union with a human partner. For the literary artist, the problem of communicating sexual experience is in some ways even more difficult than the problem of communicating mystical experience. What means of expression should he use? Scientific jargon and abstraction? Polite circumlocution? Spiritual analogies? Metaphysico-lyrical eloquence? Or the *mot juste*? Or, finally, the *gros mot*, the Saxon tetragrammaton? These were questions, as I vividly remember, which I often discussed with Lawrence after a first reading of the manuscript of *Lady Chatterley*. For Lawrence, the scientific approach was, of course, completely out of the question. Almost equally out of the question were the elegant periphrases of eighteenth-century French literature. The exquisitely refined, the almost algebraic style of those drawing-room pornographers, who could write, without raising a blush on any lady's

LITERATURE AND SCIENCE

cheek, of little deaths, of wandering fingers and strayed lips, of pleasures knocking imperiously at every door, of frustrated lovers expiring on the threshold of the temple, seemed to him positively obscene. So did a sentimental spiritualization of 'The right true end of love'. Sex in the soul repelled him as strongly as did every kind of sex in the head, from the polysyllabically scientific to the prettily and periphrastically pornographic. So far as Lawrence was concerned, there was only one right way to communicate the right kind of sexual experience, and that was by means of a soaring lyrical eloquence, firmly anchored, however, to the most uncompromisingly explicit of four-letter words. In theory, this is obviously the best possible solution to our problem. In practice, unfortunately, and at this moment of history, within this particular culture, it has its drawbacks. Being still taboo, the Saxon tetragrammata produce effects in the reader's mind out of all proportion to the frequency of their use. The Victorian novelists 'never talked obstetrics when the little stranger came' and never talked Krafft-Ebing during the honeymoon. Their books, in consequence, were unrealistic as 'criticisms of life'. But when contemporary novelists describe the various phases of the sexual cycle in words which we have been conditioned to regard as unprintable, the criticism of life becomes unrealistic through lop-sided over-emphasis. When four-letter words are used, every description of a sexual relationship carries a weight equivalent to the cube of that which its author intended it to carry. Five pages seem like a hundred and twenty-five, with the result that the balance of the book is upset and its composition distorted out of all recognition. Perhaps, after all, there was more to be said for eighteenth-century periphrases than Lawrence was ready to admit.

From the *gros mot* and the *mot juste* we pass to the indirectly expressive and essentially literary device of the metaphor. How many meanings emerge from such a phrase as 'those milk paps that through the window bars bore at men's eyes'! Or from 'the strongest oaths are straw to the fire i'the blood'! Individual instinct pitted against the repressive forces of society, the felt frenzies of desire against the conscience that makes cowards and reluctant good citizens of most of us, most of the time—these images of flame in the straw, of nipped gimlets behind a grating, evoke the everlasting conflict with incomparable power. And meanwhile, rational or violently passionate, unregenerate or saved, human beings can never forget the all-pervading facts of their mortality and of time irreversibly flowing. In the purified language of literature metaphors of winged chariots, of fading flowers, of scythes and hour glasses, communicate the many meanings of existence in a world that is perpetually perishing. And here is the manifoldly expressive image with which Lamartine begins his greatest poem.

*Ainsi toujours poussés vers de nouveaux rivages,
Dans la nuit éternelle emportés sans retour,
Ne pourrons nous jamais sur l'océan des âges
Jeter l'ancre un seul jour?*

Ships give place to shuttles, and here is Henry Vaughan on the human condition.

Man is the shuttle to whose winding quest
And passage through these looms
God ordered motion, but ordained no rest.

LITERATURE AND SCIENCE

The metaphor calls up a succession of ramifying after-images. What patterns do the incessantly hurrying shuttles weave? What is the quality of the cloth? And do the weavers *never* get a day off?

By means of metaphor we can talk about one thing in terms of something else and so, by indirection, express more of life's multiple meanings, subjective and objective, than can be expressed by straightforward speech. Literary allusion performs a very similar function:

Oh, many a peer of England brews
Livelier liquor than the Muse,
And malt does more than Milton can
To justify God's ways to man.

Theological argument or a change of body-chemistry, high philosophy or more vitamins, Calliope and Polyhymnia or the inspirations of 'ale in a Saxon rumkin, such as will make Grimalkin prate'? Housman's four lines could be expanded into volumes of scientific evidence, medical case histories, metaphysical soliloquies and ethical disputations. And when an earlier poet speaks of god-like David who,

wide as his command,
Scattered his Maker's image through the land,

how richly comic, in the historical context of Charles II and his bedroom exploits, is this allusion to Genesis and the basic postulate of Christian anthropology! From Dryden's *Absalom and Achitophel* we pass to the work of a great contemporary poet. Literary allusion (along with direct quotation and parody) is the device for expressing life's multiple meanings chiefly employed by Mr T. S.

Eliot in *The Waste Land*. The human creature's equal and opposite capacities for the squalid and the sublime, for the subtlest refinement of sensibility and the most nauseating vulgarity, for an almost boundless intelligence and an almost bottomless stupidity, are rendered by the alternation of twentieth-century observations with allusions to, quotations from, or parodies of classical, medieval and modern literature.

12

Many other devices are employed by men of letters in their constant struggle to purify, and in purifying to enrich, the language of the tribe—devices to which, because they work on that obscure region lying between consciousness and physiology, have often been qualified as 'magical'. There is the magic, for example, of unfamiliarly beautiful syntax and sentence construction; the magic of names and words that, for some obscure reason, seem intrinsically significant; the magic of well-ordered rhythms, of harmonious combinations of consonants and vowels. One thinks of such exquisite treasures of syntax as 'Not to know me argues yourselves unknown', or *Tel qu'en Lui-même enfin l'éternité le change*. And at the other extreme of phrase-making one recalls the spell-like efficacy of such juxtaposed simplicities as 'Cover her face: mine eyes dazzle: she died young'; as 'I wak'd, she fled, and day brought back my night': as 'Princess Volupine arrived; they were together, and he fell'.

The supreme masters of syntactical magic are Milton and Mallarmé. Poetically speaking, *Paradise Lost* is *Syntax Regained*—regained and completely re-made. *Rature te vague littérature*, Mallarmé advised. Scratch out all words with a too specific reference to brute reality and

LITERATURE AND SCIENCE

concentrate on the words themselves and their relationships within the phrase and sentence. Practising what he preached, Mallarmé created, in the sonnets, a repertory of syntactical marvels, unmatched in modern literature.

13

In certain contexts, intrinsically significant words and names are supremely 'right'; but their rightness is quite different from the rightness of the *mot juste*. The *mot juste* is directly and almost scientifically meaningful; the intrinsically significant word or name is meaningful because it has a beautiful sound, or because, for one reason or another, it carries a reference to realms of experience beyond itself. Thus, for Flaubert, '*La fille de Minos et de Pasiphaé*' seemed, because of the sound of the names and, no doubt, because of their ramifying mythological implications, 'the most beautiful line in all French literature, a phrase of eternal and sublime loveliness'. From Homer to Milton, every epic fairly rumbles with reverberating names. Peor and Baalim; Argob and Basna; Abbana and Pharphar, lucid streams. Elsewhere, and in lighter keys, we find such enchantments as 'crossing the stripling Thames at Bablock Hithe', or 'Amyntas now doth with his Chloris sleep under a sycamore'. ('Sycamore' is an intrinsically significant word that potentiates the idyllic love-making of Chloris and her shepherd.) On a higher level of intrinsic significance we find such Shakespearean marvels as 'defunctive music', 'sole Arabian tree', 'multitudinous seas incarnadine'. And what about Milton's 'elephants endors'd with towers'? What about 'sleek Panope' and 'that two-handed engine at the door'? And here are three stanzas from Christopher Smart's *Nativity of Our Lord*, in which the magics of harmonized sonorities

LITERATURE AND SCIENCE

and intrinsically significant names have been powerfully combined.

Where is this stupendous stranger!
Swains of Solyma, advise.
Lead me to my Master's manger,
Shew me where my Saviour lies. . . .

Boreas now no longer winters
On the desolated coast;
Oaks no more are riv'n in splinters
By the whirlwind and his host.

Spinks and ouzels sing sublimely,
'We too have a Saviour born.'
Whiter blossoms burst untimely
On the blest Mosaic thorn.

The Nativity poem was evidently written during one of those happy intervals when Smart was neither too mad nor yet too sanely well-adjusted. Excess of adjustment inhibited his genius, too much madness resulted in such eccentricities as

Let Ehud rejoice with Onocrotalus, whose braying is for the glory of God, because he makes the best music in his power.

For I bless God that I am of the same seed as Ehud, Mutius Scaevola and Colonel Draper.

Betweenwhiles (fortunately for us) there were periods of premanic exaltation, during which, breaking out of the prison of eighteenth-century culture, Smart was able to give free rein to his extraordinary poetic gifts and yet retain complete intellectual control of what he was doing.

LITERATURE AND SCIENCE

Sound, syntax, allusion, metaphor—in the *Nativity* and *A Song to David* he revealed himself as a master of these purificatory magics. And to all the rest he added the ultimate magic—the magic of what may be called verbal recklessness.

Some degree of verbal recklessness is characteristic of good poetry. There are slightly reckless good poets, and there are good poets who, at times, are extremely reckless.

It moves us not.—Great God I'd rather be
A Pagan suckled in a creed outworn;
So might I, standing on this pleasant lea,
Have glimpses that would make me less forlorn,
Have sight of Proteus rising from the sea,
Or hear old Triton blow his wreathed horn.

This is very good, but only moderately reckless. And now here is the final stanza of Yeats's *Byzantium*.

Astraddle on the dolphin's mire and blood,
Spirit after spirit! The smithies break the flood,
The golden smithies of the Emperor!
Marbles of the dancing floor
Break bitter furies of complexity
Those images that yet
Fresh images beget,
That dolphin-torn, that gong-tormented sea.

In these lines verbal recklessness is splendidly uninhibited. Yeats is purifying the words of the tribe by breaking their traditional chains of dictionary-meaning, syntactical and logical order. Of this private language of his he once wrote

I, being driven half insane
Because of some green wing, gathered old mummy wheat

LITERATURE AND SCIENCE

In the mad abstract dark, and ground it grain by grain
And after baked it slowly in an oven, but now
I bring full-flavoured wine out of a barrel found
Where seven Ephesian topers slept and never knew
When Alexander's empire passed, they slept so sound.

That barrel is the poet's pre-conscious mind—brought to the surface by the power of verbal recklessness and in its turn releasing the language of conventional speech into a wilder, foolhardier intoxication.

14

Something like a theory of verbal recklessness was formulated by Rimbaud in his famous letter to Paul Demyen. Dictionary definitions, fixed rules of syntax and grammar—such things, he proclaimed, are only for the dead, for fossils, in a word, for academicians. Every word is an idea—by which he meant, I suppose, that when isolated from the other words in relation to which it makes the ordinary, accepted kind of sense, a word takes on a new problematic, mysteriously magical significance. It becomes more than an idea; it becomes an *idée fixe*, a haunting enigma. It is possible, as Tennyson discovered, to talk oneself out of one's own familiar identity simply by repeating the syllables of one's own name. And something analogous happens when one isolates a word, pores over it, meditates upon it, treats it, not as an operational element in some familiar kind of sentence, but as a thing-in-itself, an autonomous pattern of sounds and meanings. Out of word-ideas will be forged the future universal language of poetry—a language 'resuming everything, perfumes, sounds, colours, thought-stuff hooking on to thought and tugging'. The poet must train himself to

LITERATURE AND SCIENCE

become a seer, and the function of the poet-seer is 'to determine the precise amount of the unknown manifesting itself, during his life-time, in the universal soul'. Verbal recklessness opens unsuspected windows on to the unknown. By using liberated word-ideas in a reckless way, the poet can express, can evoke, can even create potentialities of experience hitherto unrecognized or perhaps non-existent, can discover aspects of the essential mystery of existence, which otherwise would never have emerged from that

. . . multitudinous abyss
Where secrecy remains in bliss,
And wisdom hides her skill.

An ultimate and total verbal recklessness was advocated by the founding fathers of Dada. In an essay published in 1920, André Gide lucidly summarized the Dadaist philosophy. 'Every form has become a formula and distills an unspeakable boredom. Every common syntax is disgustingly insipid. The best attitude to the art of yesterday and in the face of accomplished masterpieces is not attempting to imitate them. The perfect is what does not need re-doing. . . . Already the edifice of our language is too undermined for anyone to recommend that thought should continue to take refuge in it. And before rebuilding it is essential to cast down what still seems solid, what makes a show of still standing. The words that the artifice of logic still lumps together must be separated, isolated. . . . Each vocable-island on the page must present steep contours. It will be placed here (or there, just as well) like a pure tone; and not far away will vibrate other pure tones, but without any inter-

relationships, so as to authorize no association of thoughts. Thus the word will be liberated from all its preceding meaning, at least, and from all evocation of the past'. Needless to say, it was psychologically and even physiologically impossible for the Dadaists to practise consistently what they preached. Do what they might, some kind of sense, some logical, syntactical, associational form of coherence kept breaking in. By the mere fact of being animals biologically committed to survival, of being human beings living in a certain place at a particular moment of history, they were compelled to be more consistent in thought and feeling, more grammatical and even more rational than, on their own principles, they ought to have been. As a literary movement, Dada failed. But even in its failure it rendered a service to poetry and to criticism by carrying to its logical, or rather to its illogical, conclusion the notion of verbal recklessness. In the scientist, verbal caution ranks among the highest of virtues. His words must have a one-to-one relationship with some specified class of data or sequence of ideas. By the rules of the scientific game he is forbidden to say more than one thing at a time, to attach more than one meaning to a given word, to stray outside the bounds of logical discourse, or to talk about his private experiences in relation to his work in the domains of public observation and public reasoning. Poets and, in general, men of letters are permitted, indeed are commanded, by the rules of *their* game, to do all the things that scientists are not allowed to do. There are occasions, obviously, when it is right for them to be verbally prudent; but there are other occasions when verbal imprudence, carried to a pitch if necessary, of the most extravagant foolhardiness, becomes an artistic duty, a kind of categorical imperative.

The ability to have poetical impressions is common. The ability to give poetical *expression* to poetical *impressions* is very rare. Most of us can feel in a Keatsian way, but almost none of us can write in a Keatsian way. Among other things, a poem or, in general, any work of literary art, is a device for inducing in the reader impressions of the same kind as those which served as raw materials for the finished product. It may even happen that the impressions induced in the reader's mind are of a higher order of 'poeticalness' than those from which the writer set out. At its most magical, the purified language of literature can evoke experiences comparable to the pre-mystical or fully mystical apocalypses of pure receptivity on the non-verbal level. The Not-Thought that is in thoughts, the *Istigkeit* or Essential Suchness of the world may be discovered in our experiences of a poem about a flower in the crannied wall as well as in our experience (if the doors of perception are cleansed) of the flower itself. With such fragments of apocalyptic art we may, in Mr Eliot's words, shore up our ruins, may (as Matthew Arnold phrased it) 'prop in these bad days our mind'. And the shoring and propping will be almost as effective, perhaps for some people quite as effective, as the support provided by yellow bees in the ivy bloom or a host of golden daffodils. Change the wording of a work of literary art, and straightway all its apocalyptic quality, all its mysterious ability to prop minds and shore up ruins vanish into thin air. Change the wording of a scientific paper and, so long as clarity is preserved, no loss has been suffered. The purified language of science is instrumental, a device for making public experiences understandable by

LITERATURE AND SCIENCE

fitting them into an existing frame of reference, or into a new frame of reference that can take its place among the old. The purified language of literary art is not the means to something else; it is an end in itself, a thing of intrinsic significance and beauty, a magical object endowed, like Grimm's *Tischlein* or Aladdin's lamp, with mysterious powers. Being merely instrumental, a scientific exposition can be re-organized and re-phrased in dozens of different ways, each of which will be perfectly satisfactory. And when new facts have made it obsolete, these expositions will go the way of all earlier scientific writings and be forgotten. The fate of a work of literary art is very different. Good art survives. Chaucer was not made obsolete by Shakespeare. Intrinsic beauty and significance are long-lived; instrumental information and instrumental explanations within some scientific frame of reference are ephemeral. But the sum and succession of these ephemeral productions is a monument more enduring than bronze—a dynamic monument, a Great Pyramid perpetually on the move and growing larger all the time. This formidable structure is the totality of advancing science and technology. And let us not forget that 'a heart that watches and receives'—watches Nature, watches Art, and thankfully receives whatever graces of insight they may bestow, whatever props they may offer—would soon come to a miserably bad end if it were not associated with a brain that turns raw experience into logically connected concepts, and with hands that, guided by these concepts, make novel experiments and practise familiar skills. Man cannot live by contemplative receptivity and artistic creation alone. As well as every word proceeding from the mouth of God, he needs science and technology.

Public and private. Objective and subjective. The world of concepts and the multitudinous abyss of immediate experience. The simplified, jargonized purity of scientific discourse and the magical, many-meaninged purity of literature. In this second half of the twentieth century, how should the Two Cultures of Snow's dichotomy be related?

What the relationship between them ought *not* to be is obvious. It ought not, for example, to be a relationship of the kind described by Darwin in his autobiography. As a youth, Darwin had taken pleasure in the poetry of Milton and Wordsworth; but in his later twenties he began to be afflicted by 'a curious and lamentable loss of the higher aesthetic tastes'. Milton and Wordsworth now seemed to him intolerably silly and, when he tried to re-read Shakespeare, he experienced a boredom so intense that it made him feel physically sick.

Some of the poets have been as extreme in their literary one-sidedness as was Darwin in his compulsive addiction to selected facts and the purified simplicities of scientific exposition. For example, Blake could never forgive the scientists for having analysed the divine mystery of immediate experience into its merely physical and measurable elements—'the atoms of Democritus and Newton's Particles of light'. Animated by the same anti-scientific spirit, Keats drank destruction to the man who had explained the rainbow and so robbed it of its poetry.

But one can be a practising scientist without sacrificing one's love or one's understanding of literature. Darwin's younger contemporary and champion, T. H. Huxley, has left it on record that 'I have never met with any branch of

LITERATURE AND SCIENCE

human knowledge which I have found unattractive—which it would not have been pleasant to me to follow as far as I could go; and I have yet to meet with any form of art in which it has not been possible for me to take as acute a pleasure as, I believe, it is possible for men to take'.

And from the other side of the spiritual Iron Curtain separating the Two Cultures comes the voice of William Wordsworth. Like Keats, Wordsworth was a passionate lover of rainbows ('My heart leaps up when I behold a rainbow in the sky'); and like Blake, he prized imagination, impulses from vernal woods and the 'wise passiveness' of intuition more highly than 'analytic industry' and the scientist's 'single vision' of the world. But this did not prevent him from admiring Sir Isaac, whose statue ('with his prism and silent face') was, for the young poet,

The marble index of a mind for ever

Voyaging through strange seas of thought, alone.

Alone. Despite the fact that his concern is with those less private experiences which are roughly the same in all human beings, the scientist, in Wordsworth's view, is essentially a solitary figure, self-condemned to exile from common humanity. The truth he seeks is not the intimate, felt truth of our subjective life. It is truth from the outside, organized into a system of merely rational explanation, by a process of abstraction and hypothesis. The man of science is radically unlike the poet who, 'singing a song in which all human beings join with him, rejoices in the presence of truth as our visible friend and hourly companion'. The poet, Wordsworth continues, 'is the rock of defence for human nature; an upholder and preserver, carrying everywhere with him relationship and love. In spite of difference of soil and climate, of language and

manners, of laws and customs; in spite of things silently gone out of mind, and things violently destroyed, the Poet binds together by passion and knowledge the vast empire of human society, as it is spread over the whole earth and over all time. . . . Poetry is the first and last of all knowledge; it is as immortal as the heart of man. . . . If the labours of Men of science should ever create any material revolution, direct or indirect, in our condition, and in the impressions which we habitually receive, the Poet will sleep then no more than at present; he will be ready to follow the steps of the Men of science, not only in those general indirect effects, but he will be at his side, carrying sensations into the midst of the objects of science itself. The remotest discoveries of the Chemist, the Botanist, or Mineralogist, will be as proper objects of the Poet's art as any upon which it can be employed, if the time should ever come when these things shall be familiar to us, and the relations under which they are contemplated by the followers of these respective sciences shall be manifestly and palpably material to us as enjoying and suffering beings. If the time should ever come when what is now called science, thus familiarized to men, shall be ready to put on, as it were, a form of flesh and blood, the Poet will lend his divine spirit to aid the transfiguration, and will welcome the Being thus produced as a dear and genuine inmate of the household of man'.

'If the time should ever come. . . .' In that *if* resides our whole problem. *If* all of us were as passionately interested in, say, the genetics of earthworms or the atomic hypothesis, as we are in our friendships, our arthritis or our sex life, *then*, obviously, there would be only one culture, not two. Poets would write lyrics indifferently about Nucleic Acid and their coy mistresses, about Quantum Mechanics

and the death of children; and research workers would find it pleasant and even profitable to read these lyrics. But the hypotheses of physics and the data of genetics and bio-chemistry seem important only to a minority. Most people are little interested in science as dispassionate observation, still less interested in science as a rational system of explanatory concepts. And even in the field of applied science, of science as it is embodied in technology, their concern is only with such matters as affect them personally. 'If the labours of Men of science should ever create any material revolution. . . .' Even in Wordsworth's time these labours had begun to create a very considerable material revolution. Today that revolution is chronic and galloping.

A material revolution is never merely material. It begets parallel revolutions in many other realms—social, political and economic revolutions, revolutions in philosophical and religious thought, revolutions in ways of life and modes of individual behaviour. It is with these consequences of advancing technology, not with technology as a set of practical receipts, technology as the application of scientific theories, that most human beings are concerned.

17

As a class, men of letters have reacted to science and technology in much the same way as the majority of their less talented fellows. They have not been greatly interested in science as a set of logically coherent hypotheses validated operationally by experiment and dispassionate observation. And in the field of applied science their concern has been mainly with the social and psychological consequences of advancing technology, very little with its

working or its underlying theories. In the whole corpus of classical literature there is only one poem that celebrates a labour-saving machine—Antipater's brief piece in the Greek Anthology about the water-driven mill that had freed the slave women from the daily drudgery of grinding wheat or barley into flour. And in modern times Diderot is the only considerable writer who took the trouble to acquaint himself with the technology of his time, and who used his talents in order to communicate his knowledge. Most men of letters, when they write about technology, do so only as enjoying and suffering beings, not as accurate observers interested in the embodied logic of machinery. In the golden age of steam engines Tennyson seems to have believed that trains ran, not on rails, but in 'ringing grooves'. Ruskin objected to locomotives because their manufacturers had not disguised them as fire-breathing dragons. Victor Hugo wrote enthusiastically about the *Great Eastern*—but in words so wildly rhetorical that no concrete ideas about the size, appearance and capacities of Brunel's famous ship can be derived from them. Gabriele d'Annunzio's lyrical response to the internal combustion engines of aeroplanes and racing cars are hardly more realistic than Victor Hugo's dithyrambs about steamers and railway engines. At least in their published works, these writers exhibited very little interest in the scientific theories underlying the technological achievements of their time, even less interest in the methods by which these theories were applied to the solution of practical problems.

It is worth remarking in this context that, until very recent times, the creators of Utopias have been abysmally

uninventive in the fields of pure and applied science. A lively scientific and technological imagination is a by-product of rapidly advancing science and technology. In an age of primitive science and rudimentary technology, even the most brilliantly original minds are incapable of imagining a state of affairs radically unlike that with which they are familiar. Leonardo made designs for tanks and air-conditioning machines; but he was unable to imagine any sources of power different from those available at the beginning of the sixteenth century—the power developed by human and animal muscles, and the power developed by wind and falling water. The ‘projectors’ of the seventeenth century talked grandiosely about mechanized agriculture; but their giant combines were to be driven by windmills—consequently could never work. From the days of Icarus until 1783, the problem of flying was thought about in terms of artificial wings flapped by the movements of human arms and legs. After Montgolfier, Utopian phantasy was able to conjure up visions of manned gas bags with masts and sails. A few years later the imaginary dirigibles were provided with reciprocating steam engines and aerial paddle wheels. In the eighteen-sixties Jules Verne’s more daring flights of fancy were made possible by another half-century of accelerating scientific and technological progress. In the hundred years that have passed since the inventor of Science Fiction embarked on his career, science and technology have made advances of which it was impossible for the author of *From the Earth to the Moon* even to dream. Rooted as they are in the facts of contemporary life, the phantasies of even a second-rate writer of modern Science Fiction are incomparably richer, bolder and stranger than the Utopian or Millennial imaginings of the past.

From this brief excursion into the history of scientific fancy I pass to scientific facts and theories, and the ways in which at successive periods of history, these facts and theories have influenced literary artists, especially the poets.

Greece had a long tradition of utilitarian-didactic and scientifico-philosophic poetry. Hesiod's *Works and Days* contains, among other matters, a brief metrical treatise on agriculture and sheep-herding. Scientific and philosophical poetry was the product of a later age than Hesiod's. Unfortunately only a few fragments survive of the poem in which Parmenides expounded his theories about the One and the Many, contrasting conceptual 'truth' with merely probable 'opinions' about observed phenomena. And the same fate befell the splendid work in which Empedocles obscurely foreshadowed a theory of elementary particles, a theory of random variations and combinations resulting in something like the survival of the fittest, and a theory of the dependence of mental upon bodily states, with its curious corollary that ethics is largely a matter of correct diet. Passing from Greek to Latin literature, we find two perfectly preserved masterpieces, the *De Rerum Natura* of Lucretius and Virgil's *Georgics*—the first a scientific and philosophical work on the grandest scale, the second a set of versified essays, miraculously poetical, on the charms of country living and the techniques of agriculture. As science became more systematic, didactic poetry gave place to expository prose. In recent European literature the full-blown didactic poem, on themes of pure or applied science, becomes an anomaly and an anachronism, attractive only to a special

LITERATURE AND SCIENCE

breed of second-rate poets. The *Georgics* are succeeded, in modern times, by John Phillips's *Cyder*, Dyer's *Fleece*, the Abbé Delille's *Les Jardins*. And in place of *De Rerum Natura* we get Tiedge's dismal *Urania* and the elegant absurdities of Erasmus Darwin. In recent centuries no poet of the first rank has even tried to do what Lucretius and Empedocles did. Where scientific theory and scientific information have entered poetry, it has been incidentally. But the problem of the right relationship between literature and science presents itself even when a poet's references to scientific facts and theories are of the most casual nature. Consider, for example, these two stanzas, the first from John Donne's *A Valediction*, the second from *The Extasie* by the same poet.

Moving of th'earth brings harms and fears;
Men reckon what it did and meant;
But trepidation of the spheres,
Though greater far, is innocent.

And

As our blood labours to beget
Spirits, as like souls as it can,
Because such fingers need to knit
That subtle knot which makes us man . . .

Donne was well informed about the science of his day and, in these learned similes, he made a most ingenious use of his knowledge to illustrate his private experience of parting and of nuptial consummation. For readers brought up on the natural philosophy of the Schoolmen, his scientific allusions must have seemed brilliantly illuminating. But ours is the universe, not of Ptolemy and Galen, but of Palomar and Jodrell Bank, of bio-chemistry

LITERATURE AND SCIENCE

and the EEG. If we still read Donne, it is because, in his own strange way, he gave a purer sense to the words of the tribe and because, in those purified words, he movingly expressed certain private experiences very like our own. We do not read him because he was knowledgeable in pre-Copernican astronomy and pre-Harveian physiology. The trepidation of the spheres, the animal and vital spirits—these things do not interest us. Why should they? We know that spheres and spirits don't exist and, unless we happen to be well-read in the history of obsolete science, we have no idea why the spheres trepidated or how the blood-begotten spirits knitted their subtle knot.

Similar difficulties confront the modern student of Dante. Why do we continue to read the *Divine Comedy*? Because its author saw clearly, felt intensely and was supremely, almost miraculously, a purifier of words. But as well as a poet, Dante was a scholar, a man of profound learning, interested in all the problems of philosophy and science as they were posed, discussed and (so the Schoolmen bumptiously believed) definitively solved by the metaphysicians and theologians of his time. Reading the *Divine Comedy*, the modern student is confronted by passages which, because they refer, in a marvellous kind of poetic shorthand, to the facts and theories of medieval science, are incomprehensible. What, for example, is he to make of

*il settentrion del primo cielo
che nè occaso mai seppe nè orto
nè d'altra nebbia che di colpa velo,*

*e che faceva lì ciascuno accorto
di suo dover, come il piu basso face
qual timon gira per venire a porto?*

LITERATURE AND SCIENCE

Without the assistance of an editor and an apparatus of scholarly notes, the twentieth-century reader does not and cannot know what Dante is talking about.

In so far as he concerns himself with his own and other people's more private experiences, 'the Poet', as Wordsworth says, 'binds together by passion and knowledge the vast empire of human society, as it appears over the whole earth and over all time'. But when they concerned themselves with the other kind of knowledge—knowledge of external facts correlated within a logically coherent system of concepts—even the greatest poets completely failed to bind the empire of human society 'over all time'. After a few centuries, or a few generations, their scientific similes and illustrations, once so vivid, so penetratingly topical, lost their point and became at last completely incomprehensible. And the more precise the references to obsolete science, the more grotesque will they seem to readers of a later and, scientifically speaking, more enlightened age. Dante's cosmology is extremely precise. It is this precision which makes his incidental references to science so obscure and which invests his picture of the universe (that stuffy, all-too-human cosmos of the Middle Ages, in which everything in Nature is merely an illustration of some notion of Aristotle's, some phrase in the Bible) with its curious and rather distasteful quality of sublime absurdity.

For the readers of a later age, the scientific and theological imprecisions of Shakespeare are preferable to the more exact expressions of Dante or Donne.

Sit, Jessica. Look how the floor of heaven
Is thick inlaid with patens of bright gold.
There's not the smallest orb which thou behold'st

LITERATURE AND SCIENCE

But in his motion like an angel sings,
Still quiring to the young-eyed cherubins;
Such harmony is in immortal souls,
But whilst this muddy vesture of decay
Doth grossly close it in, we cannot hear it.

The Ptolemaic system, the Pythagorean music of the spheres, Aristotle's *De Coelo*, Jewish and Christian angelology—the whole elaborate apparatus of classical and medieval science, philosophy and theology is here taken for granted. But fortunately Shakespeare refrains from going into details. There are none of Donne's trepidations, none of Dante's Septentrions of the First Heaven. The imagery is precise on the poetical, not on the scientific level. It is only implicitly that Shakespeare tells us about his astronomical and philosophical theories. Explicitly he is talking about two lovers and their reactions to a starlit summer night.

From the sixteenth we jump to the nineteenth century, and an eloquent piece of free verse by Walt Whitman, a sonnet by Gerard Manley Hopkins.

When I heard the learn'd astronomer,
When the proofs, the figures, were ranged in columns
before me,
When I was shown the charts and diagrams, to add,
divide, and measure them,
When I sitting heard the astronomer where he lectured
with much applause in the lecture-room,
How soon unaccountable I became tired and sick,
Till rising and gliding out I wandered off by myself,
In the mystical moist night air, and from time to time,
Looked up in perfect silence at the stars.

LITERATURE AND SCIENCE

Grau, theurer Freund, ist alle Theorie, Und gruen des Lebens goldner Baum. For some people the contemplation of scientific theories is an experience hardly less golden than the experience of being in love or looking at a sunset. Whitman was not one of them. As an enjoying and suffering being, he was left cold by the facts and hypotheses of astronomy; he preferred silence and the stars. For a poet, this is an entirely legitimate preference. Not at all legitimate, it seems to me, is Hopkins's reaction to starlight in terms of an obsolete astronomy with animistic overtones.

Look at the stars! Look, look up at the skies!
O look at all the fire-folk, sitting in the air!
The bright boroughs, the circle-citadels there!

This, surely, is to make the worst of both worlds—theory and life, concepts and immediate experience. In these opening lines of an otherwise admirable sonnet, Hopkins, the incomparable renderer in purified words of a sensibility that could capture the essences, the characteristic 'inscapes' of unique events, lapses into the rhetoric of scientific theory—of a theory, moreover, that, at the time he wrote, had been untenable for at least two hundred years. Those 'fire-folk sitting in the air', those 'bright boroughs' and 'circle citadels' might have served the 'learn'd astronomer' of the sixteenth century as explanatory concepts. Under the pen of a Victorian poet, even of a Victorian poet whose favourite philosopher was Duns Scotus, they are simply inadmissible.

Dante's Septentrions of the First Heaven, Donne's trepidations and blood-begotten spirits—for the modern reader,

LITERATURE AND SCIENCE

such references to an obsolete science are mere obstacles to understanding and sympathy. Does this mean that the modern man of letters should take his cue from Whitman—paying the tribute that literature owes to science by attending the learn'd astronomer's lecture, only to reassert literature's complete autonomy by sneaking out, before the end, and looking up in perfect silence at the stars? My own belief is that he should try to make the best of all the worlds in which, willy-nilly, he has to live—the world of stars and the world of astro-physics, the world of crowded halls and the world of silence, the worlds of grey theory, green life and many-coloured poetry. But Donne and Dante are there to demonstrate that, in a matter of centuries or even of years, an allusion to science may become incomprehensible. What of that? Even when he says he is writing for posterity, the man of letters is in fact addressing a contemporary audience. The audience may consist, for the moment, only of himself; but even a soliloquy is not immediately addressed to posterity. Moreover, even if one does write for posterity, the chances that posterity will read what one has written are pretty slim. And there is another point to remember. It is unlikely that present-day science will become as totally obsolete as the science of an earlier day, whose towering theories were built upon inadequate foundations and whose explanatory concepts had never been operationally defined and validated. Between Dante's universe and the universe of modern astronomy there is a difference in kind; but between the universe of modern astronomy and the universe of astronomy two or three centuries from now there will, in all probability, be a difference only in degree and in detail. Our ancestors' references to trepidations and the first heaven are now incomprehensible. But *our* refer-

LITERATURE AND SCIENCE

ences to extra-galactic nebulae and supernovae will probably make quite good sense even to our great-great-grandchildren. Twentieth-century science is operationally validated and so is unlikely to become as completely obsolete as the science of the past. And, even if it should become so obsolete that our descendants cannot understand our scientific allusions, what matter? Our descendants will not be reading us anyhow—so why worry? Why not get on with the job—the surely important and necessary job—of breaching the spiritual Iron Curtain?

21

Before embarking on speculations about what ought to be done, or what might be done by men of letters in a scientific age, let us consider what in fact has been done. How have modern poets reacted to the great scientific discoveries of our century, to its fantastic inventions, to its vast structures of logically coherent, pragmatically useful, and yet wildly improbable concepts? To what extent has the subject matter of poetry, or even its casual images and illustrations, been affected by the extraordinary things that have been happening, for the last two or three generations, in the fields of scientific thought, investigation and experiment, of technological invention and application? These are questions which I posed, more than forty years ago, in an essay on the subject matter of poetry; and this is how, more than forty years ago, I answered them.

“The propagandists would have us believe that the subject matter of contemporary poetry is new and startling, that modern poets are doing something which has not been done before. “Most of the poets represented in these pages”, writes Mr Louis Untermeyer in his *Anthology*

LITERATURE AND SCIENCE

of Modern American Poetry, "have found a fresh and vigorous material in a world of honest and hard reality. They respond to the spirit of their times; not only have their views changed, their vision has been widened to include things unknown to the poets of yesterday. They have learned to distinguish real beauty from mere prettiness, to wring loveliness out of squalor, to find wonder in neglected places, to search for hidden truths even in the dark caves of the unconscious". Translated into practice, this means that contemporary poets can now write, in the words of Mr Carl Sandburg, of the "burr and boom of the blast fires", of "wops and bohunks". It means, in fact, that they are at liberty to do what Homer did—to write freely about the immediately moving facts of everyday life. Where Homer wrote about horses and the tamers of horses, our contemporaries write of trains, automobiles and the various species of wops and bohunks who control the horsepower. That is all. Much too much stress has been laid on the newness of the new poetry; its newness is simply a return from the jewelled exquisiteness of the eighteen-nineties to the facts and feelings of ordinary life. There is nothing intrinsically novel or surprising in the introduction into poetry of machinery and industrialism, of labour unrest and depth psychology; these things belong to us, they affect us daily as enjoying and suffering beings; they are a part of our lives, just as the kings and warriors, the horses, the chariots, the picturesque mythology, were part of Homer's life. The subject-matter of the new poetry remains the same as that of the old. The old boundaries have not been extended. There would be a real novelty in it if it had worked out a satisfactory method for dealing with scientific abstractions. It has not'.

LITERATURE AND SCIENCE

In the forty years that have passed since these words were written has there been any significant change in the poetical situation? Several greatly gifted writers have purified and enriched the language of English and American poetry, have created and developed new rhythms, new metrical forms, new magics of syntax, sound and verbal recklessness. But the domain of poetry has not been notably enlarged. 'T. S. Eliot must be saluted', writes Mr Kenneth Allott, 'for his extension of the field of subject-matter available for poetic treatment. Christianity, the modern industrial city and the background of European history are found a place in his poetry, as MacNeice has remarked, and wit, irony and satire are weapons at his command'. But one may also remark, without the aid of Mr MacNeice, that Christianity has for some time been the subject-matter of quite a lot of poems, that modern industrial cities could not have been written about in the days before they existed and that European history was copiously treated by Victor Hugo, for example, and Robert Browning. As for wit, irony and satire—these can hardly be regarded as novelties. Eliot is a great poet because he purified the words of the tribe in novel, beautiful and many-meaning ways, not because he extended the field of subject-matter available to poetic treatment: he didn't. And this is true of most of his poetical successors. From their writings you would be hard put to it to infer the simple historical fact that they are the contemporaries of Einstein and Heisenberg, of computers, electron microscopes and the discovery of the molecular basis of heredity, of Operationalism, Diamat and Emergent Evolution. Scientific facts and theories, the logical-empirical philosophy of science and the more comprehensive philosophies of man and

LITERATURE AND SCIENCE

nature which may legitimately be drawn from science as it is related to private experience in a particular social and historical context—these have as yet hardly found their way into modern poetry. Thus, the historians of modern English and American literature speak of the nineteen-twenties as 'being concerned in poetry with culture and the preservation of tradition'—Snow's non-scientific culture, of course, and the Judaeo-Christian and Graeco-Roman traditions associated with that culture. The poets of the nineteen-thirties displayed (in the jargon of modern criticism) a 'marked insistence on social reference'. So did the author of *Piers Plowman*, so did Shelley in *The Mask of Anarchy*. There is no enlargement of the poetic domain, merely the re-occupancy of a neglected province. The forties witnessed a reaction from 'social reference' to 'self-unravelling', Christianity and neo-romanticism. In the fifties we find a bit of everything—everything, that is to say, except an insistence on the kind of scientific reference that one might have expected to be a feature of poetic writing in a time of enormous progress in pure and applied science. In the forty years which have elapsed since I first commented on the old subject-matter of the new poetry, astonishingly few poems with a scientific reference have been written. Some elegant pieces of Neo-Metaphysical poetry by William Empson, Kenneth Rexroth's reflective lyric, 'Lyell's Hypothesis Again'—these are the only examples that come, offhand, to my mind. There must, of course, be others—but not many of them, I am sure. Of the better poems written since 1921, the great majority do not so much as hint at the most important fact of contemporary history—the accelerating progress of science and technology. In so far as they affect the social, economic and political situation in which

LITERATURE AND SCIENCE

individuals find themselves, some of the consequences of progressive science receive attention from the poets; but science as a growing corpus of information, science as a system of concepts operationally defined, even science as a necessary element in the formulation of a tenable philosophy of nature and man, science in a word as science, is hardly even mentioned. More exclusively even than their predecessors in earlier centuries, modern poets concern themselves with their own and other people's more private experiences as these are evoked by nature, by social pressures, by theological and political notions, by love and pain and bliss, by bereavement and the prospect of death.

22

That the poetry of this most scientific of centuries should be, on the whole, less concerned with science than was the poetry of times in which science was relatively unimportant is a paradox that requires to be elucidated and explained. To begin with, the very fact that this is an age of science has relieved poetry of the need to have much direct and detailed scientific reference. Progress in science has begotten progress in the popularization of science. Every year witnesses the publication of literally scores of surveys and bird's eye views of all the sciences, of summaries of recent advances, digests of current modes of thinking. 'Popular Science' is a new art form, partaking simultaneously of the text book and the *reportage*, the philosophical essay and the sociological forecast. There is now no necessity for science to enter poetry except by philosophic implication, as one of the indispensable constituents in a tenable world-view, or else by way of meaningful illustration or expressive metaphor. That so

LITERATURE AND SCIENCE

few contemporary poets should go in for scientific reference on a large scale or in detail is not surprising. What is surprising is that there are not more of them to whom, as to Tennyson, for example, and Laforgue, science is a personal-metaphysical concern, as well as a concern on the political and cultural levels of public experience.

In the good old days, we are often told, science was a great deal simpler than it is at present. Even a poet could understand the Darwinian hypothesis in its primitive form—could understand and rejoice, if he were a free-thinker, over its anti-theological implications or, if he were an orthodox Christian, react indignantly or with nostalgic tears to what *The Origin of Species* had done to Noah's Ark and the first chapter of *Genesis*. Today the picture, once so beautifully clear, has had to incorporate into itself all the complexities of modern genetics, modern bio-chemistry, even modern bio-sociology. Science has become an affair of specialists. Incapable any longer of understanding what it is all about, the man of letters, we are told, has no choice but to ignore contemporary science altogether.

And yet, for all the labyrinths within labyrinths revealed, as scientific analysis probes ever deeper into the fine structure of the world, the great philosophical problems remain—although seen in a different light—what they have always been: enormous, glaring, inescapable. Nature is just as red in tooth and claw as it was in Victorian times—and humanity, alas, far redder. We know a great deal more than Tennyson's contemporaries did about the 'flaring atom streams, running along the illimitable inane'—and much less than some of them thought they knew about a Creator within or beyond the atom stream. Is ours the only intelligence in an otherwise

LITERATURE AND SCIENCE

mindless infinity? We have better reasons than the Victorians had for believing that there are other habitable planets revolving about distant suns—thousands of millions of them in the single cosmic parish of our own galaxy. Tennyson was sure that the dark little worlds running round those other suns ‘are worlds of woe like our own’. We have no good reason for disagreeing. *Woe* rhymes with *know*, suffering is a resultant of embodied awareness, a consequence of being a sentient individual. We are back again at the heart of the problem of mind. Where does consciousness fit into the cosmic picture? How did the illimitable inane get on without the perceiving, feeling and thinking inhabitants of this and all the other dark little worlds of woe, bliss, love, and frustration—not to mention poetry and science? And how will it get on when we are all gone?

*Et ces couchants seront tout solitaires,
Tout quotidiens et tout supré-Véda,
Tout aussi vrais que si je n'étais pas,
Tout à leur affaire.*

*Ah! ils seront tout aussi quotidiens
Qu'au temps où la planète à la dérive
En ses langes de vapeur primitive
Ne savait rien d'rien.*

*Ils seront tout aussi à leur affaire
Quand je ne viendrai plus crier bravo!
Aux assortiments de mourants joyaux
De leur éventaire.*

*Qu'aux jours où certain bohème filon
Du commun néant n'avait pas encore
Pris un accès d'existence pécore
Sous mon pauvre nom.*

LITERATURE AND SCIENCE

What is and what ought to be, human aspiration and natural phenomena—the problems that were raised by science three and four generations ago are still with us, and the philosophers of science are still trying to work out acceptable solutions. But the poets, oddly enough, don't seem to be interested.

23

From the poets we now pass to the dramatists. What is the extent of *their* interest in science?

The function of drama is to arouse and finally allay the most violent emotions, and its basic theme is conflict—conflict between passionate individuals or conflict between one passionate individual and the categorical imperatives of his society. Violent emotions related to conflict—these are the most absorbing of our more private experiences; and the most enduringly popular works of art are always those which stir up such emotions. Bad, exciting art has always been good enough for the majority; the more civilized minority demands stimulants of a subtler, richer and more elegant kind. Today the majority can get what it wants from whodunits and the popular press. The minority professes to be shocked because the majority's favourite newspapers give so much space to crimes of violence, such tall headlines to any kind of sexual scandal. But from its first invention, crimes of violence and sexual scandal have been the subject matter of drama. Stripped of their poetry the plots of all the world's great tragedies are simply items from the front page of the *Police Gazette*.

In high tragedy as in low journalism there is no room for the dispassionate observations, the marshalled data and logical thinking of science. This incompatibility

LITERATURE AND SCIENCE

reflects the huge historical fact of humanity's never ending civil wars—the wars between reason and the instincts, reason and the passions, reason and rationalized unreason, reason in the guise of enlightened self-interest and the criminal lunacies that sanctify themselves as idealism and get organized as religions, moralities and public policy. From age to age this civil war remains forever the same; but its manifestations change with changing circumstances. Thus in the Age of Faith the much-touted essence of Christian unity was qualified (to use the language of the Schools) by the observable accidents, throughout Christendom, of almost incessant mutual throat-cutting. Today, on either side of the Iron Curtain, we are all humanists. Ours is the Age of the Welfare State. It is also the Age of Concentration Camps, Saturation Bombing and Nuclear Armaments. And, on the conceptual level, we live in an Age of Pure Science and Analytical Philosophy that is, at the same time and even more characteristically, an Age of Nationalistic Idolatry, Organized Lying and Non-Stop Distractions.

Surely, it's obvious.

Doesn't every schoolboy know it?

Ends are ape-chosen: only the means are man's.

Papio's procurer, bursar to baboons,

Reason comes running, eager to ratify . . .

Comes with the Calculus to aim your rockets

Accurately at the orphanage across the ocean;

Comes, having aimed, with incense to impetrate

Our Lady devoutly for a direct hit.

In this civil war the literary artist finds himself qualified by his special talents to play two important parts—that of war correspondent and that of propagandist. As the

LITERATURE AND SCIENCE

professional recorder of man's more private experiences, he observes the various manifestations of unreason, negative and positive, conceptualized or in the raw, and can see how they are related to the public world of social organizations and philosophical systems. Moreover, possessing as he does a special gift for purifying words, he is in a position to make effective propaganda for either of the two combatants. Will he range himself with reason in the service of Decency? Or with rationalization in the service of the Immanent Baboon? Is he using his gifts to work for more life, more love, more freedom? Or does he

Come, a catch-fart with Philosophy, truckling to tyrants,
Come, a pimp for Prussia, with Hegel's patent History?

He is free—freer than most people, for most people are inescapably enmeshed in some powerful social organization—to make the choice.

Many writers have, as a matter of plain historical fact, made the wrong choice. Again and again, genius and reputation have been placed at the disposal of Power, Vested Interest and Rationalized Unreason. 'Time' (as W. H. Auden writes in his admirable poem on the death of Yeats),

Time that is intolerant
Of the brave and innocent,
And indifferent in a week
To a beautiful physique.

Worships language and forgives
Everyone by whom it lives;
Pardons cowardice, conceit,
Lays its honours at their feet.

LITERATURE AND SCIENCE

Time that with this strange excuse
Pardoned Kipling and his views,
And will pardon Paul Claudel,
Pardons him for writing well.

Hamlet and *Agamemnon* are as full of horrors as the tabloids; but because Shakespeare and Aeschylus gave a purer sense to the words of their respective tribes, we forgive them and at the same time forgive ourselves, as we listen to those marvellous words, for enjoying the violent emotions which their renderings of homicide and sexual scandal so powerfully evoke.

Science is a matter of disinterested observation, unprejudiced insight and experimentation, patient ratiocination within some system of logically correlated concepts. In real-life conflicts between reason and passion the issue is uncertain. Passion and prejudice are always able to mobilize their forces more rapidly and press the attack with greater fury; but in the long run (and often, of course, too late) enlightened self-interest may rouse itself, launch a counter-attack and win the day for reason. In the fictional world of the drama, this is not likely to happen. To begin with, we go to the tragic theatre in order to be excited, go for the express purpose of vicariously living through the violent feelings associated with crime and sexual scandal. If there is to be any talk about reason and disinterested awareness, any reference to science as information, science as theory and science as a basis of a general philosophy, it must come in the course of digressions from the main theme of emotion-arousing conflict. But plays are short and the art of telling a story and describing characters in dramatic terms is long. The author of a tragedy has little time, and his audience even less patience, for digressions from the emotion-arousing

situations which are the substance of all high drama. In comedy the conflicts are less irreconcilable and the feelings aroused, less violent. Digressions, in consequence, seem less digressive and are listened to, not merely in patience, but with positive pleasure. That supreme master of dramatic digression, Bernard Shaw, enjoyed an enormous popularity. (It should be remarked, incidentally, that Shaw used his mastery to talk a good deal of eloquent nonsense about Darwinian biology and, in his *Black Girl*, Pavlovian psycho-physiology.)

24

The novel and the essay are art forms far more tolerant of digressions than comedy even at its most conversational. Provided the writing is good enough, most things can be said in an essay and practically anything, from the most intensely private of subjective experiences to the most public of observations and reasonings, can find its place in a novel. We see then, that in poems and tragedies scientific reference can only be slight. There is more scope for it in comedy, but not nearly so much scope as in the essay or the three hundred-page narrative.

I am not qualified, nor in this context is it necessary for me, to write a comprehensive History of Scientific Reference in Literature. Our main concern is not with the past, but with the present and the immediate future. Whether we like it or not, ours is the Age of Science. What can a writer do about it? And what, as a conscientious literary artist and a responsible citizen, ought he to do about it?

First and most important, the writer must perform to the best of his ability the tasks for which his talents uniquely qualify him—namely, to render, in words purer

LITERATURE AND SCIENCE

than those of the tribe, his own and other people's more private experiences; to relate these experiences in some humanly satisfying way to public experiences in the universes of natural facts, linguistic symbols and cultural conventions; and to get on with the job of making the best of all the worlds in which human beings are predestined to do their living and their dying, their perceiving, feeling and thinking. Literature gives a form to life, helps us to know who we are, how we feel and what is the point of the whole unutterably rummy business. Our immediate experiences come to us, so to say, through the refracting medium of the art we like. If that art is inept or trivial or over-emphatic, our experiences will be vulgarized and corrupted. Along with unrealistic philosophy and religious superstition, bad literature is a crime against society.

Schizophrenics live almost exclusively in the world of private experience; but for healthy people, their private world is always experienced, or at least thought about, in relation to a number of public worlds. Large areas of this public domain have been mapped and systematically described, on every conceptual level from the sub-atomic to the biological and the psychological, by men of science. How should the literary artist relate himself to this hierarchy of scientific domains?

The pre-condition of any fruitful relationship between literature and science is knowledge. The writer, whose primary concern is with purer words and the more private of human experiences, must learn something about the activities of those who make it their business to analyse man's more public experiences and to co-ordinate their findings in conceptual systems described in purified words of another kind—the words of precise definition

LITERATURE AND SCIENCE

and logical discourse. For the non-specialist, a thorough and detailed knowledge of any branch of science is impossible. It is also unnecessary. All that is necessary, so far as the man of letters is concerned, is a general knowledge of science, a bird's eye knowledge of what has been achieved in the various fields of scientific enquiry, together with an understanding of the philosophy of science and an appreciation of the ways in which scientific information and scientific modes of thought are relevant to individual experience and the problems of social relationships, to religion and politics, to ethics and a tenable philosophy of life. And, it goes without saying, between the Two Cultures the traffic of learning and understanding must flow in both directions—from science to literature, as well as from literature to science.

'*Je crois peu,*' said Victor Hugo, '*à la science des savants bêtes.*' His scepticism was understandable, but not, as we shall see, justifiable. The number of *savants bêtes* is very considerable, and growing all the time. Here is what an able scientist, Dr J. Gillis of the Weizman Institute in Israel, has to say on this subject. 'Let us face the facts. A large number of young people take up scientific research as a career these days, but regrettably few are impelled into it by a passionate curiosity as to the secrets of nature. For the vast majority it is a job like any other job. . . . Moreover it is not generally realized outside of academic circles how far a mediocre research worker can get. With the exception of pure mathematics nearly all scientific research is now done by teams, and the spectrum of ability of teams members can be very wide—and flat. Indeed one can hold a respected job and even make a worthwhile contribution to the world by having sufficient intelligence to do what one is told . . . and the devotion

LITERATURE AND SCIENCE

required to come to work on time and perform it honestly. In commerce and industry there are those who are exceptionally endowed with brilliance, ruthlessness or luck and achieve proportionate success; then come the vast majority who somehow manage to get through, and the minority who go under. The proportion of scientists who actually go under is probably much lower and the weeding out process is correspondingly less effective. Indeed the relative security and stability of the research career are probably more attractive to mediocrities than the romance of enquiry is to the brilliant ones. And without this great intellectual proletariat of research how far should we get?

A century ago the intellectual proletariat of research was but a tiny fraction of the vast intellectual proletariat of research today. But it was evidently large enough, even then, to have attracted Victor Hugo's attention. The *savant bête* was one of the phenomena of modern life which that consummate journalist, the author of *Choses Vues*, had clearly recognized, and to which the poet-turned-philosopher reacted by refusing to believe in the correctness of stupid people's findings. We who are contemporary with the explosive growth in numbers of the intellectual proletariat of research can admire the sharp-eyed journalist and sympathize with the poet-philosopher. But since we are also contemporary with an unprecedentedly rapid advance in science and technology, we have to recognize the fact that, though understandable, the poet-philosopher's scepticism was unjustified. Victor Hugo thought that, like creativity in literature, creativity in science was entirely dependent on individual talent. And of course it is still true that revolutionary advances in scientific thinking and experimentation are made by out-

LITERATURE AND SCIENCE

standing individuals. But these break-throughs into new territory require to be consolidated and widened; and for this task a force of intellectual proletarians is necessary and, provided they obey the rules of the scientific game, qualitatively adequate. One of the great achievements of science is to have developed a method which works almost independently of the people by whom it is operated. Men and women with only enough intelligence to do what they are told and only the devotion required to come to work on time can, by using the method, extend and apply scientific knowledge. These members of the intellectual proletariat of research are *savants bêtes*, much less interesting than successful professionals in other fields; but the method they use is a sufficient substitute for personal ability.

25

In the hierarchy of the sciences, atomic physics is the most exact, the most completely expressible in terms of mathematics, and the most remote from immediate experience. For the writer, atomic physics is interesting, above all, for the way in which it illustrates the workings of the scientific mind as it moves from a set of sense perceptions to a set of unobservable, hypothetical entities and back again to another set of sense perceptions, in relation to which the concepts of the atomic hypothesis are operationally validated. In the words of an eminent physicist, Werner Heisenberg, 'for the first time in history man, on this planet, is discovering that he is alone with himself, without a partner and without an adversary'. To put it more picturesquely, man is in process of becoming his own Providence, his own Cataclysm, his own Saviour and his own invading horde of Martians. And in the realm of pure

LITERATURE AND SCIENCE

science the same discovery—that he is alone with himself—awaits him as he progressively refines his analysis of matter. ‘Modern science,’ says Heisenberg, ‘shows us that we can no longer regard the building blocks of matter, which were considered originally to be the ultimate objective reality, as being things “in themselves” . . . Knowledge of atoms and their movements “in themselves”, that is to say independent of our observation, is no longer the aim of research; rather we now find ourselves from the very start in the midst of a dialogue between nature and man, a dialogue of which science is only one part, so much so that the conventional division of the world into subject and object, into inner world and outer world, into body and soul, is no longer applicable and raises difficulties. For the sciences of nature, the subject matter of research is no longer nature in itself, but nature subjected to human questioning, and to this extent man, once again, meets only with himself’.

To the literary artist who has been concerned with man’s more private experiences, this talk about the inappropriateness of the conventional notions of objective and subjective, outer and inner, has a familiar ring. It reminds him of certain utterances of the poets and the mystics. Carried far enough, the analysis of man’s public experiences comes, in theory at least, to the same conclusion as is reached existentially in the most private of all private experiences—infused contemplation, *samadhi*, *satori*.

Satori, *samadhi*, infused contemplation—how many questions, literary, scientific and philosophical, cluster about these words! For example, what kind of purified language

will be required to do justice to an experience which may be 'explained' equally well in terms of ancient poetical paradoxes, or of the latest neuro-pharmacology? Zen or psilocybin? Patanjali or Dr What's-his-name of I forget which Mental Hospital? Unrepeatable experiences communicated in the purified, many-meaninged words of literature, or a logically coherent, jargonized discourse, made up of words with only a single meaning, about the similarities between unique events, the common factors in reported experiences, the average of observed behaviours. A literary artist with a survey-knowledge of the relevant sciences and an enormous gift of language will no doubt find a way to make the best of both worlds. And attacking the same problem from their side of the spiritual Iron Curtain, the scientists should also look for ways to make the best of both worlds. At present all too many scientists, especially the *savants bêtes* of research's intellectual proletariat, seem to think that theories based upon the notion of 'nothing-but' are somehow more scientific than theories consonant with actual experience, and based upon the principle of not-only-this-but-also-that. For example, to call psilocybin a 'psychotomimetic agent' and to equate the experiences it induces with those of certifiable lunatics, is regarded as being thoroughly 'scientific'. To call it a 'psychodelic', or soul-revealing, agent and to point out that the psilocybin experience is felt by most subjects to be uniquely significant and that its effects are often enlightening and transforming—this is felt to be dangerously 'unscientific'. If the *savants bêtes* had their poet, he would tell them, no doubt, that 'We needs must love the lowest when we see it', and must also be very careful to shut our eyes to everything except the lowest. The intelligent scientist who pays attention to his own private ex-

LITERATURE AND SCIENCE

periences and has read what others report of theirs, will find himself in agreement with the intelligent writer, who has paid attention to what the scientists have to say about public experiences. Together, they will work for the creation of a comprehensive philosophy in which it will be obvious that, while high can always be reduced to low, low can always emerge into high; a philosophy that will analyse and classify, but make it clear, at the same time, that analysis and classification, though absolutely necessary, must never be taken too seriously and that in spite of science, in spite of the notions of 'common sense' imposed upon us by the vocabulary, grammar and syntax of our unpurified language, reality remains for ever whole, seamless and undivided.

27

Biology, it is obvious, is more immediately relevant to human experience than are the exacter sciences of physics and chemistry. Hence, for all writers, its special importance. The sciences of life can confirm the intuitions of the artist, can deepen his insights and extend the range of his vision. Writers, spiritual directors, men of affairs—'all these people', writes Professor A. H. Maslow, 'may have wonderful insights, ask the questions that need to be asked, put forth challenging hypotheses, and may even be correct and true much of the time. But however sure *they* may be, they can never make mankind sure. . . . Science is the only way we have of shoving truth down the reluctant throat. Only science can overcome characterological differences in seeing and believing. Only science can progress'.

The sciences of life have need of the artist's intuitions and, conversely, the artist has need of all that these

LITERATURE AND SCIENCE

sciences can offer him in the way of new materials on which to exercise his creative powers. And humanity at large—the race of multiple amphibians, uneasily living at one and the same moment in four or five different and disparate universes—has need of the syntheses which only the man of letters with ‘a heart that watches and receives’ and a bird’s-eye knowledge of science can provide. Such fusions of public and private, of fact and value, of conceptual knowledge and immediate experience, of scientifically purified discourse and the purer words of literature, are possible in every domain accessible to perception, feeling and thought.

The proper study, or at least one of the properest studies, of mankind is man. What have poets, dramatists, story tellers and philosophical essayists contributed to this study in the past? What are scientists contributing now? And what should be the attitude of the twentieth-century man of letters toward these scientific contributions to the study of man? How can he make use of them, improve upon them, incorporate them into works of literary art?

28

The word ‘man’ is currently used in at least three principal senses. Thus it may stand for humanity at large, for the whole species as it now exists on this planet. Or it may stand, rather vaguely, for an average of people’s behaviour within some specified culture at some particular period of history. We speak, for example, of Primitive Man, Classical Man, Western Man, Post-Historic Man, and so forth. The cultural varieties of *Homo sapiens* are almost as numerous as the breeds of dogs and almost as dissimilar. And finally the word, ‘man’, may refer to the

LITERATURE AND SCIENCE

unique individual, to any one of the three thousand million human anatomies and physiologies, the three thousand million *loci* of private and unshareable experience, now extant.

Until very recent times even the best-informed of philosophers and literary artists knew nothing about man-the-species, and very little about man-the-product-of-culture. The earth was largely unexplored, archaeology had not been invented and such historians as existed were the chroniclers of local events, whose ignorance of all but a very few alien cultures was complete. Virtually everything we now know about ourselves as the resultants of evolution, as the earth's dominant, wildly proliferating and most destructive species, as the creators, beneficiaries and victims of culture, as the genius-inventors and idiot-dupes of language, has come to us, during the last three or four generations, from palaeontologists and ecologists, from systematic historians and, in all their variety, from the social scientists. And from geneticists, neurologists and bio-chemists has come, in great measure during the present century, most of what we now know about human beings as members of the animal kingdom, as living organisms with an inherited anatomy and an inherited chemical and temperamental individuality. Some of this new knowledge—especially the new social, linguistic and historical knowledge—has been built into the frame of reference, within which men of letters, along with most of their contemporaries, perceive, feel, think and express themselves. The rest, to a great extent, still remains outside the pale of literature, unassimilated by those whose traditional function it is to study man as unique person, culture-product and species, and to communicate their findings—their 'criticism of life', in

Arnold's phrase—in the purified language of literary art.

29

Who are we? What is our destiny? How can the often frightful ways of God be justified? Before the rise of science, the only answers to these questions came from the philosopher-poets and poet-philosophers. Thus, in India the engima of man's individual and collective destiny was unriddled in terms of a theory—implausibly simple and suspiciously moralistic—of re-incarnation and *karma*. Present good luck was the reward for past virtue, and if you were suffering now, it was your fault—you had sinned in a previous existence. Liberation from the endlessly turning wheel of birth and death, the everlasting succession of do-it-yourself heavens and strictly home-made hells—this is the goal of life, the ultimate reason for human existence.

In the Christian West the riddle was solved (or perhaps it would be truer to say that it was re-stated) in terms of some completely unobservable act of supernatural predestination—an act for which no logical and even, in the absence of a belief in reincarnation, no ethically acceptable reason could be given. It was a matter simply of the arbitrariness of omnipotence, of God's good pleasure.

Man's destiny is a matter, among other things, of the observable differences between human individuals. Are these differences inherited or acquired, or inherited *and* acquired? For many centuries it seemed reasonable to debate the problem of Nature versus Nurture in terms of theology and metaphysics. Augustinians fought with Pelagians; proto-Behaviourists, such as Helvétius, reacted

against Jansenist Christianity by maintaining, in the teeth of all probability and on no evidence whatever, that any shepherd boy from the Cevennes could be transformed, by suitable tutoring, into another Isaac Newton or (if the tutor preferred) into a replica of St Francis of Assisi. 'Everything', said Rousseau, 'is good that comes from the hands of the Creator; everything is perverted by the hands of man.' The Creator is now out of fashion; but environmental determinism remains the frame of reference within which many social scientists and many men of letters still do their feeling and their thinking. Theirs, surely, is an inexcusable one-sidedness; for the science of genetics has been with us for a long life-time and the unscientific study of innate human differences is as old as literature. At no period and in no place would any dramatist or story-teller in his right mind have dreamed of clothing the character, say, of Falstaff in the physique of Hotspur, or the temperament of Mr Pickwick in the body of Uriah Heep.

The beginnings of a science of human destiny (in so far as our destiny depends upon our innate idiosyncrasies) are to be found in the humoural theories of Greco-Roman medicine. Men are alike inasmuch as all human bodies secrete the four humours. Their dissimilarities result from the fact that these humours are mixed in different proportions. Disease results from a temporary upsetting of the normal balance of the humours. Congenitally, everyone has his own unique temperament or mixture of humours. When the mixture is altered, there is distemper. (This last word has come down in the world. In the sixteenth century even a king could be distempered. Today, for some odd historical reason, distemper is the name exclusively of a disease of dogs and cats.)

LITERATURE AND SCIENCE

Ben Jonson's dramatic typology was based upon the most advanced scientific theories of his age. They were crude theories, and for this reason Ben's characters seem less real, less fully human, than do those of his less scientific contemporary, the creator of Falstaff and Cleopatra.

It was not until the twentieth century that science at last caught up with literature and began to correlate differences of physique with differences of temperament and behaviour. What the men of letters had done intuitively was now done methodically by the experimenters and the statisticians. On the level of anatomy, genetic predestination was studied by Kretschmer, Stockard, and William Sheldon; on the bio-chemical level, by Roger Williams and, in relation to the insane, by Hoffer, Osmond, Heath, Altdorf and numerous workers in Russia and Czechoslovakia. It is now clear that a propensity to schizophrenia, and perhaps to other forms of severe mental illness as well, is innate. So too are certain propensities to the kind of behaviour that we describe as delinquent. *Crime as Destiny* was the title of a book (published in English, with an introduction by J. B. S. Haldane, in 1930) in which Johannes Lange summarized the results of his work on pairs of identical and identically criminal twins. Twenty years later a correlation between delinquent behaviour and certain inherited patterns of physique and temperament was established by the researches of Sheldon and the Gluecks.

Manners maketh man, but on the other hand *you can't make a silk purse out of a sow's ear*. The old proverbs flatly contradict one another, but are both correct. Predestined by their heredity, human beings are post-destined by their environment. A mildly bad predestination may be

offset by a more than averagely good post-destination; but even the best of post-destinations has never as yet shown itself capable of nullifying the effects of a very bad predestination.

From individual *karma* we now pass to the enigma of collective destiny. Kipling was probably wrong in asserting that there were lesser breeds without the law. But, along with many other observers, he was probably right in thinking that the manifest differences between racial temperaments were more than merely cultural and must be due, at least in part, to hereditary factors.

This intuitive hunch has received a measure of scientific confirmation from the recent research into the relationship between blood types and temperament carried out by the French anthropologist and psychologist, Léone Bourdel. In a given collectivity the predominance of one or other of the four blood types—A, B, O and AB—is a kind of immanent social destiny. For example, peoples with a relative predominance in their population of B-blood 'are by nature the most spontaneously warlike'. Again, 'wherever A's and B's confront one another in sufficient numbers, friction instantly arises. The clash is between two contrasting ways of life, two biological rhythms, two metaphysics, two modes of government, irreducibly different in each case one from the other'. An A-type temperament being irreducibly different from a B-type temperament, it follows that AB individuals grow up to be the victims of a built-in *angoisse psychologique*. Furthermore, societies with a predominance of AB's in their population are foredoomed to an existence of chronic restlessness, a history of permanent revolution. (AB peoples, we are told, inhabit the Balkans, the lands of

LITERATURE AND SCIENCE

the Near East, Central America and the northern part of South America.)

To the twentieth-century man of letters science offers a treasure of newly discovered facts and tentative hypotheses. If he accepts this gift and if, above all, he is sufficiently talented and resourceful to be able to transform the new raw materials into works of literary art, the twentieth-century man of letters will be able to treat the age-old, and perennially relevant theme of human destiny with a depth of understanding, a width of reference, of which, before the rise of science, his predecessors (through no fault of their own, no defect of genius) were incapable.

30

The ways of God have never been justified, but they can be explained, at least partially, in non-theological terms. Why do these things happen to us? As we have seen, a number of fragmentary, but nonetheless useful and even enlightening answers to the riddle of human destiny are now forthcoming. And the same thing is true of the closely related riddle of human nature. Who or what are we? A complete scientific answer to this question is still lacking. We know a great deal, but we do not yet know how to correlate what we know into an explanation. In the words of a very able contemporary psychologist, Dr H. J. Eysenck, 'we have no recognized hypothesis to account for the apparent interaction of mind and matter in a simple act of consciousness, nor is there any official hypothesis to account for the phenomena of hypnosis or of memory'.

What we do have, however, is a great mass of facts unco-ordinated in terms of a comprehensive theory, but in-

trinsically interesting, suggestive, speculation-provoking—such stuff, in a word, as literature is made of. Who are we, and how did we come to be what we are? From age to age the makers of literature have proposed an answer to this question in terms of whatever factual observations, whatever explanatory notions, passed in their time for scientific. Going back to the beginnings of our own literary tradition, we find that, in Homer's day, a human being had no unitary soul. His psyche was merely the shadowy thing that feebly squeaked and gibbered in the world of the dead. In the world of the living a human being was simply an uneasily co-operative society of somato-psychic factors—a parliament in which the nominal prime minister, *Nous* or Reason, was constantly being outvoted by the spokesmen of the opposition parties of Animal Vitality, Emotion and Instinct. And it was not merely with *Phren*, *Thumos* and the Liver that Reason had to cope; there were also the gods. Supernatural intervention was constant and generally malicious. One of Zeus's numerous daughters was *Até*, whose name, in the Homeric poems, means 'the state of mind-body that leads to disaster'. *Até* amused herself by playing havoc with rational man's best-laid plans and noblest intentions. And when it wasn't *Até* who made the mischief, it was one of the high gods personally intervening, so that some unfortunate human being might suffer undeserved pain or perpetrate some act of suicidal idiocy.

But divine interventions were not invariably malicious. Inspiration by one or other of the Muses was an actual experience, and from time to time some god or other would intervene to help one of his favourites. Moreover there was something called *Menos*, the state of mind-body that leads to success. Entering a man, *Menos* enormously

LITERATURE AND SCIENCE

increased his native capacities, making it possible for him to achieve what had hitherto been impossible.

Homer's analysis of human nature makes us smile. But let us never forget that, although less knowledgeable than we, our ancestors were no stupider. Consider, for example, those odd and embarrassing events, about which we now think in terms of a number of moderately scientific hypotheses—a hypothesis of innate instinctual drives, a hypothesis of neurotic obsessions and hysterical inhibitions, a hypothesis of conditioned reflexes, habit formation and learning, and a hypothesis of inherited or acquired bio-chemical anomalies. By those to whom they happen these odd events are commonly experienced as gradual or sudden invasions of the self by irresistibly powerful forces from some alien 'out there', which is yet within us. For this reason, the most obvious and plausible explanation of some of the very peculiar things we feel, think, say and do is an explanation in terms of a comprehensive theory of supernatural intervention. Indeed, before the systematic accumulation of physiological and psychological facts, and the formulation of working hypotheses based upon those facts, no other theory of human nature was able to 'save the appearances'. The hypothesis that human beings are subject to assaults and possessions by supernatural entities remained the only adequate explanation of man's observed behaviour until, in very recent times, naturalistic theories of psycho-chemical interaction, of learning and conditioning, and of a dynamic unconscious, were developed to take its place.

Contact with Indian gymnosophists to the east or, as some contemporary scholars believe, contact to the north with the shamans of the Central Asiatic steppes led to the abandonment of the Homeric view of human nature. The

LITERATURE AND SCIENCE

debating society of somato-psychic factors gave place to the dualism of a soul, confined, as in a penitentiary or a tomb, within a body, whose inert matter it informed and animated. The notion of a detachable psyche imprisoned in a muddy and decaying soma gave birth to the notions of original sin and concurrently of an undiluted spirituality, to which there could be no access save through a course of physical mortifications. Orphism and the Pythagoreans prepared the way for Plato and, reinforced by Persian dualism, the new theory of human nature entered our cultural history on the carrying wave of Christianity. Mediaeval theology enriched this theory of human nature by incorporating into it the hypotheses of Aristotelian science. Vegetative, animal and rational, the soul was a trinity in unity; and this trinity in unity informed a body which was a variously mingled four-in-one of hot, cold, moist and dry, of sanguine, phlegmatic, choleric and melancholic. This mediaeval threesome within a foursome was even more liable than the old somato-psychic debating society had been to supernatural interventions. To Homeric superstition, Persians, Jews and Christians had added their repulsive phantasies of unremitting assaults by innumerable fiends, of diabolic infestations, of pacts between would-be magicians and the denizens of that solidly material hell, in which, according to the most reliable theologians, ninety-nine hundredths of the human race were predestined to suffer everlasting torment.

Eccentric as these old theories of human nature now seem, the fact remains that they worked. Guided by the traditional anthropology and their own intuitions, our ancestors managed to survive, to make technological progress, to create viable social organizations and splendid

LITERATURE AND SCIENCE

works of art. Only too frequently, it is true, they took their theories too seriously, mistook poetical fancies for established truths, picturesque metaphors for reality, the verbiage of philosophizing *littérateurs* for the word of God. When this happened, disasters inevitably followed. Obeying the dictates of an unrealistic anthropology and world-view, they embarked upon courses of personal and collective insanity—frightful self-torture and the equally frightful persecution of heretics; the repudiation of instinctual life and the sadistic torturing of wretched women accused of witchcraft; puritanism and the launching of crusades, the waging of hideously savage wars of religion. The notions *we* take too seriously are not the same as those which drove our fathers into their maniacal aberrations. But, though the causes differ, the results, at least on the collective level, are identical. Their unrealistic theories of man's nature and the nature of the world made it mandatory for them to bully, persecute and kill—always in the name of God. We too kill, persecute and bully, but not in order to propitiate Allah or to gratify the Holy Trinity. Our collective paranoia is organized in the name of the idolatrously worshipped Nation or the Divine Party. The misused notions, the overvalued words and phrases are new; but the resultant slaughters and oppressions are dismally familiar. Science, it seems hardly necessary to remark, provides no justification for slaughter and oppressions. Hand in hand with progressive technology, it merely provides the means for implementing the old insanities in a novel and more effective way. The ends subserved by science are formulated in terms of what is most unscientific in our current view of the nature and potentialities of human beings, and of the point—the biological and psychological purpose, so

LITERATURE AND SCIENCE

far as man-the-species and man-the-unique-person are concerned—of being alive and human. To keep drawing attention to this grotesque and increasingly dangerous state of affairs is surely one of the functions, one of the prime duties, of the twentieth-century man of letters.

3 I

We begin with the primitive monism of Homer's debating society of somato-psychic factors. We move on to the Scythian shamans, with their mediumistic techniques of 'travelling clairvoyance', and from shamanism to the Orphic, Pythagorean and Platonic theories of man as a detachable, autonomous unitary soul boxed up in a corporeal prison-tomb. From these we pass to the Christian hypothesis of man—a hypothesis that fluctuated between an almost Manichaeian dualism and a kind of residual monism, expressing itself in the obscure eschatological doctrine of the resurrection of the body. Unmitigated dualism comes in with Descartes, and for more than two centuries remains the theory, in terms of which men of science and, with few exceptions, men of letters do their thinking about the human organism and its relationship to the external world. The nineteenth century witnessed the emergence of psychology as an independent science and of psychiatry as a medical speciality. The study of hypnosis revealed the interesting fact that many of the curious phenomena once attributed to supernatural intervention could be reproduced by suggestion or the 'magnetic passes', and could best be explained in terms of a theory of unconscious mental activity.

William James dated the birth of specifically modern psychology from the publication, in the early eighteen-eighties, of a paper by F. W. H. Myers, setting forth a

theory (later developed at length in Myers' posthumous *Human Personality*) of the subliminal self. In 1895, after experimenting for some years with novel therapeutic techniques, Freud published his first book and formulated his famous theory of human behaviour in terms of libido, repression and a dynamic unconscious. Freud's hypothesis was less comprehensive than that of Myers; for, unlike his older English contemporary, he paid very little attention to what may be called the positive side of the unconscious. Myers was more interested in Menos than in Até; Freud's primary concern was with the state of mind that leads to disaster, not with the state of man that leads to success. As a research physician, with a large clientèle of hysterical and neurotic patients, he had ample opportunities for observing the destructive activities of Até, very few for observing the influxes of Menos, the visitations of the Muses, the phenomena of 'enthusiasm' (*en- theos*—God inside), or the admonitions of the kind of daimon that spoke to Socrates.

Freud's one-sided view of the unconscious was corrected by C. G. Jung—but corrected with a vengeance. Jung was interested in Menos; but he seems to have believed that Menos could do its beneficent work only by means of an enormous apparatus of symbols. Thanks to the inheritance of acquired characteristics, we are all born with a full supply of archetypes. For Jung, the unconscious was a populous mythological pantheon. Freud saw it rather as an underground urinal, scribbled over (for the symbols in which Freud was interested were almost exclusively sexual) with four-letter graffiti. Significantly enough, the patients of Freudian therapists regularly dream in Freudian symbols, whereas the patients of Jungian therapists always come up with archetypes. A

LITERATURE AND SCIENCE

neurotic is said to have achieved insight when, thanks to a steady bombardment of explicit or covert suggestions, he accepts his therapist's pet theory of human nature.

32

The Freudian hypothesis is open to criticism on many scores. It uses words which sound and read like scientific terms, but which are in fact not scientific at all, inasmuch as they have never been operationally defined. For example, the super-ego is supposed to be formed by the 'introjection' of the father figure into the child's unconscious mind. But the word 'introjection' is never defined in operational terms and so remains almost meaningless. And now let us consider the psycho-analytic interpretation of dreams. The proof that Freud's theory of dreams is correct resides in the fact that dream interpretation in terms of censorship and wish-fulfilment is in perfect accord with his fundamental theory of human nature. The correctness of the dream theory follows from the correctness of the fundamental hypothesis. And the fundamental Freudian hypothesis is proved to be correct by the fact that it is consonant with Freudian dream interpretation. Q.E.D.

To these logical deficiencies of the Freudian theory must be added its one-sidedness and an over-simplification of the problem under study by a wholesale and wholly unwarranted disregard of relevant facts. The hypothesis of unconscious mental activity is valid and of very great practical importance. Without it, we should be compelled to fall back on primitive notions of supernatural intervention. With it, we can offer partial explanations of some kinds of normal behaviour and can help some of the victims of the milder forms of mental illness to get rid of

their symptoms. But to be adequate as a realistic explanation of the observed facts, and as a principle dictating therapeutic procedures, a merely psychological theory of human nature as a product of the interaction of conscious and unconscious mental activities, in relation to present and past environments, requires to be supplemented by other theories, based upon facts of a different order. Men and women are much more than the locus of conscious and unconscious responses to an environment. They are also unique, inherited patterns (within a unique, inherited anatomy) of biochemical events; and these patterns of bodily shape and cellular dynamics are in some way related to the patterns of an individual's mental activity. Precisely how they are related we do not know, for we have as yet no satisfactory hypothesis to account for the influence of matter upon mind and of mind upon matter. But the fact of their interaction has always been obvious, and a detailed knowledge of the fields in which bodily events determine and are in turn determined by mental events is steadily growing.

The basic Freudian hypothesis is an environmental determinism that ignores heredity, an almost naked psychology that comes very near to ignoring the physical correlates of mental activity. Freudian case histories very seldom contain a detailed description of the patient who is being treated. Is she one of those women who run to fat, or is she congenitally slender? Is he a driving mesomorph, or an over-sensitive, introverted ectomorph? We are not told. And yet every man of letters, from Homer's time to the present, has always known that the proper study of mankind can never be successful unless such questions are asked and conscientiously answered. And for every psychologist, scientific or intuitive, practical or

LITERATURE AND SCIENCE

theoretical, it is no less important to know something about the inner workings as well as the size and shape of the body connected with a given set of mental activities. But in orthodox Freudian literature bodies in their totality are almost never discussed. True, the mouth and the anus receive a good deal of attention—but after all, there is nothing in between.

33

Because of all these grave weaknesses, orthodox Freudism is giving way in therapy to an eclectic approach. There is a growing recognition of the inescapable fact that men and women are multiple amphibians inhabiting half a dozen disparate universes at the same time. It is only by attacking the problem of human nature on all its fronts—the chemical and the psychological, the verbal and the non-verbal, the individual, the cultural and the genetic—that we can hope to understand it theoretically and to do something about it in educational and therapeutic practice. Freud made significant contributions to the problem of human nature on one sector of one front, the psychological. The results of his work are now in process of being correlated with the results of work by other researchers on other sectors of the same front, as well as on many other fronts.

34

The scientific theory of human nature that is now emerging is a good deal closer to the Homeric notion of a debating society of somato-psychic factors than to the more 'spiritual' hypothesis of an autonomous, unitary, detachable soul imprisoned in a body, or the deceptively commonsensical Cartesian notion of a soul attached,

LITERATURE AND SCIENCE

somehow or other, to an automaton. A kind of prophetic summary of the new, non-Cartesian, non-Platonic view of man was given by William Blake in *The Marriage of Heaven and Hell*;

‘All Bibles or sacred codes have been the causes of the following Errors.

1. That Man has two real existing principles, Viz: a Body and a Soul.
2. That Energy, call’d Evil, is alone from the Body, & that Reason, call’d Good, is alone from the Soul.
3. That God will torment Man in Eternity for following his Energies.

But the following Contraries to these are True.

1. Man has no Body distinct from his Soul; for that call’d Body is a portion of Soul discern’d by the five Senses, the chief inlets of Soul in this age.
2. Energy is the only life and is from the Body, and Reason is the bound or outward circumference of Energy.
3. Energy is Eternal Delight.’

This is not merely a forecast of future scientific findings; it is also a programme for a future literature. Thanks to the work in many fields of a host of scientific enquirers, thanks also to the philosophers of emergence and organization, the literary artist is now in a position to embark upon that programme. In Blake’s day, body-soul convertibility was a hypothesis without a solid factual foundation and without adequate philosophical buttresses and superstructures. In ours, the basic information and the co-ordinating philosophy are there, waiting to be transfigured, challenging men of letters to purify the words of their tribe so as to make them capable of doing justice to a

theory of human nature, subtler and more comprehensive than any of the theories elaborated by the philosopher-poets and proto-scientists of earlier centuries.

35

To think at once scientifically and artistically about the problems of manifold amphibiousness and multiple causation is difficult and laborious. It is much easier, much more wish-fulfilling, to think of human problems in terms of single causes and magically efficacious panaceas. That, no doubt, is why, in the recent past, men of letters have paid so much more attention to psycho-analysis than to the less spectacular, less pretentious, but more enlightening hypotheses contributed to the common store of scientific knowledge by physiologists and bio-chemists, by experimental psychologists, social scientists and anthropologists. The very fact that it was one-sided and over-simple made the Freudian hypothesis attractive. A more genuinely scientific hypothesis of human nature fails to attract precisely because it is genuinely scientific—because it refuses to over-simplify, but insists on doing justice to many aspects of an enormously complex reality.

In this context it is worth remarking that men of letters are ready to work very hard on obscure subjects of a non-scientific kind, but are not prepared to invest a comparable amount of labour in the artistic transfiguration of intrinsically less obscure scientific raw materials. Here, by way of example, are the opening lines of Ezra Pound's 'Near Perigord'

*A Perigord, pres del muralh
Tan que i puosch' om gitar ab malh.*

LITERATURE AND SCIENCE

You'd have men's hearts up from the dust
And tell their secrets, Messire Cino,
Right enough? Then read between the lines of *Uc St. Circ*,
Solve me the riddle, for you know the tale.

And so the poem proceeds—Browning in modern dress, but a modern dress patched with bits of old Provençal, tagged and tasselled with all manner of mediaeval liripips. To catch the drift of what is being communicated, the average cultivated reader must work as hard on the quotations and historical allusions as he would have to work on the technical terms of an article in *Nature* or the *Archives of Neurology*.

Needless to say, there is no one-to-one correspondence between the merits of a work of literary art and the importance of its subject. Trivial events and commonplace ideas have served as the raw material for immortal writings. Conversely, in the hands of well-intentioned but untalented writers high themes turn into the flattest kind of literature. But where there is an equal display of talent, a good piece of literature dealing with some intrinsically interesting and important subject is surely preferable to a good piece of literature dealing with a subject of little interest and no importance. To me at least the facts recorded and the explanatory hypotheses put forth by scientific students of the age-old problem of man in his multiple amphibiousness seem particularly interesting and important—more interesting and more important than, for example, the mediaeval anecdote which is the theme of Mr Pound's poem. I admire the poem, but wish that its author, *il miglior fabbro* and consummate purifier of the words of the tribe, might have used his talents to transfigure some of the findings of modern science, thus making it possible for this new raw material to take

LITERATURE AND SCIENCE

its place, along with the traditional subject matters of poetry, in a work of the highest literary art.

Man, the multiple amphibian, lives in a chronic state of mild or acute civil war. The proper study of mankind is always a study of the 'fierce dispute betwixt damnation and impassioned clay', of that

wearisome condition of humanity,
Born under one law, to another bound;
Vainly begot, and yet forbidden vanity;
Created sick, commanded to be sound.

And Fulke Greville concludes his stanza with a question:

What meaneth Nature by these diverse laws,
Passion and reason, self-division's cause?

To the old answers, theological, metaphysical and palaeophysiological, twentieth-century science has added answers of a different kind. The fierce dispute betwixt damnation and impassioned clay is now regarded as the expression of the fact that an ancient brain stem is associated with an overgrown, upstart cortex; that an endocrine system evolved for survival in the wild is built into the bodies of men and women living under conditions of complete domestication, in cages of words, within the larger confines of one or other of the cultural zoos. And for every individual the situation is complicated by the fact that he is anatomically and bio-chemically unique. His differences from other individuals are, for him, almost as important as his resemblances to them—in some cases, indeed, they are felt to be even more important. The explanatory hypotheses of modern science are not given to us in immediate experience. But neither were the explanatory hypotheses of theology and metaphysics. In this particular context, our immediate experience is only

LITERATURE AND SCIENCE

of the chronic civil war within ourselves, and of its consequences; anxiety, rage, frustration and so forth. Explanations in terms of God and Satan, of sin, conscience and categorical imperative, of *karma* and grace and predestination, are just as inferential, just as rationalistically public, as are the scientist's explanation in terms of evolution and neurology, of bio-chemical uniqueness at odds with cultural demands for uniformity.

An individual's reaction to a public hypothesis may be a private experience of great intensity. Thus, in the past, severe attacks of depression and suicidal despair were common among those tender-minded persons who took too seriously the hallowed notions of eternal punishment for sinners who had infringed the rules laid down by the local culture. Desolation as a subjective reaction to the public hypothesis of hell might give place to consolation as a subjective reaction to the public hypothesis of atonement. Analogously, subjective reactions to the public hypotheses of Lyellian geology and Darwinian biology took the form, in some individuals, of a joyous and entirely private sense of release from the shackles of ancient superstition, in others of a mournful sense of loss, an unshareable experience of being all alone in an unfriendly universe.

Subjective reactions to the hypotheses of human nature enunciated by modern science may take the form of private distress, private exultation, or private indifference—it is a matter of temperament and upbringing. The point to bear in mind is that, however unobservably inferential and rationally public, the scientific hypotheses of man in his multiple amphibiousness may very easily evoke, in a culture-conditioned mind, unshareable experiences of pleasure or distress, of forward-looking hope or

nostalgic melancholy. In the past men of letters found it very easy to incorporate the all too humanly dramatic and picturesque hypotheses of theology and metaphysics into their poems, plays and narratives. Consider, for example, the perennially interesting topic of man's inner weather, with its sudden alterations of feeling tone, world-view and value judgments. How simple it was for George Herbert to relate these private experiences to the public doctrines of his Church! 'Who would have thought my shrivelled heart Could have recovered greenness?' he asks. But in fact, it *did* recover greenness, so that 'now in age I bud again; After so many deaths I live and write'.

These are thy wonders, Lord of Power,
Killing and quickening, bringing down to hell
And up to heaven in an hour.

Again, 'how rich, O Lord, how fresh thy visits are!' (The words are from a lyric by Henry Vaughan)

'Twas but just now my bleak leaves hopeless hung,
Sullied with dust and mud. . . .
But since thou didst in one sweet glance survey
Their sad decays, I flourish and once more
Breathe all perfumes and spice.

In these two exquisitely beautiful poems private experience is harmonized with the public world-view of a religious philosophy that still regarded supernatural intervention as a sufficient explanation of unusual psychological happenings. For the twentieth-century man of letters this temptingly easy way out is barred. The only explanatory hypotheses that it is permissible to incorporate into a contemporary poem about changing moods are those of contemporary science. We have unshareably private experiences of alternating hell and heaven, of May

mornings eclipsed, from one moment to the next, into December midnights. Privately, these experiences *feel* as though they were the operations of some indwelling god or demon. But on the public level of rational inference, we have every reason to believe that they are the results of events taking place within the organism. We have learned that there is an endocrinology of elation and despair, a chemistry of mystical insight, and, in relation to the autonomic nervous system, a meteorology and even, according to Professor Piccardi, an astro-physics of changing moods.

The hypotheses of modern science treat of a reality far subtler and more complex than the merely abstract, verbal world of theological and metaphysical notions. And although a determinant of human nature and human behaviour, this reality is non-human, essentially undramatic, completely lacking in the obvious attributes of the picturesque. For these reasons it will be difficult to incorporate the hypotheses of science into harmonious, moving and persuasive works of art—much more difficult, obviously, than it was to incorporate the notions of diabolic obsession or of a Lord of Power arbitrarily quickening and killing the souls of His creatures. But for any serious and gifted artist a difficulty is never an insurmountable obstacle; it is a challenge to intellectual combat, a spur to further achievement. The conceptual and linguistic weapons with which this particular combat must be waged have not yet been invented. We do not know and, until some great artist comes along and tells us what to do, we shall not know how the muddled words of the tribe and the too precise words of the text books should be poetically purified, so as to make them capable of harmonizing our private and unshareable experiences with

the scientific hypotheses in terms of which they are explained. But sooner or later the necessary means will be discovered, the appropriate weapons will be forged, the long-awaited pioneer of genius will turn up and, quite casually, as though it were the most natural thing in the world, point out the way. What that way will be, is of course completely unpredictable. To forecast what Shakespeare would do with the drama, a critic would have had to be another Shakespeare. In which case, needless to say, he would not have wasted his time talking about new kinds of literature; he would have made them.

36

The proper study of mankind is Man and, next to Man, mankind's properest study is Nature—that Nature of which he is an emergent part and with which, if he hopes to survive as a species, if he aspires to actualize the best of his individual and collective potentialities, he must learn to live in harmony. On this enormous theme what additional raw materials for the creation of new works of art can science bring to the man of letters?

Let us begin with ecology and its practical applications in the techniques of conservation, management of resources, pest control, breeding of resistant strains, hybridization and all the other arts by means of which man tries to maintain or, if it does not already exist, to create a satisfactory relationship with his natural environment. These arts and the accumulated facts and scientific theories upon which they are based, are not merely interesting in themselves; they are also profoundly significant for their ethical and philosophical implications. In the light of what we now know about the relationships of living things to one another and to their inorganic environment

LITERATURE AND SCIENCE

—and also of what, to our cost, we know about overpopulation, ruinous farming, senseless forestry and destructive grazing, about water pollution, air pollution and the sterilization or total loss of productive soils—it has now become abundantly clear that the Golden Rule applies not only to the dealings of human individuals and human societies with one another, but also to their dealings with other living creatures and the planet upon which we are all travelling through space and time.

‘Do as you would be done by.’ Would we like to be well treated by Nature? Then we must treat Nature well. Man’s inhumanity to man has always been condemned; and, by some religions, so has man’s inhumanity to Nature. Not, however, by the religions which regard God as wholly Other, a Being apart from the created world. By these man’s inhumanity to Nature is implicitly condoned. Animals, said the theologians of Catholic orthodoxy, are without souls and may therefore be used as though they were things. The ethical and philosophical implications of modern science are more Buddhist than Christian, more Totemistic than Pythagorean and Platonic. For the ecologist, man’s inhumanity to Nature deserves almost as strong a condemnation as man’s inhumanity to man. Not only is it profoundly wicked, and profoundly stupid, to treat animals as though they were things, it is also wicked and stupid to treat things as though they were *mere* things. They should be treated as though they were component parts of a living planetary whole, within which human individuals and human societies are tissues and organs of a special kind—sometimes, alas, horribly infected, riddled with proliferating malignancy.

For the Greeks of classical antiquity, *hubris*, that violent and overweening bumptiousness which is so

LITERATURE AND SCIENCE

odiously characteristic of civilized humanity, was no less a sin when directed against Nature than when directed against one's fellow men. The essential soundness of their ethical intuitions in this matter is attested by the findings of contemporary science. So too is their feeling for moderation in all things, their dislike of extremes and one-sidedness. Nature, we now know, is a system of dynamic balances, and when a state of equilibrium has been disturbed, always attempts to establish a new balance between the forces involved. The ideal of the golden mean has its roots in the natural order. Between some classes of observed facts and some classes of felt values, certain bridges are discernible. For the literary artist whose properest study is Man, and whose next most proper study is Nature, the existence of such bridges is a matter of the highest importance. On this middle ground between two universes, traditionally regarded as completely disparate, he will be able to discover the raw materials for a new kind of Nature-literature.

37

Science sometimes builds new bridges between universes of discourse and experience hitherto regarded as separate and heterogeneous. But science also breaks down old bridges and opens gulfs between universes that, traditionally, had been connected. Blake and Keats, as we have seen, detested Sir Isaac Newton because he had cut the old connections between the stars and the heavenly host, between rainbows and Iris, and even between rainbows and Noah's Ark, rainbows and Jehovah—had cut the connections and so de-poetized man's world and robbed it of meaning. But in an age of science the world can no longer be looked at as a set of symbols,

standing for things outside the world. *Alles Vergaengliche ist NICHT ein Gleichnis*. The world is poetical intrinsically, and what it means is simply itself. Its significance is the enormous mystery of its existence and of our awareness of that existence. Wordsworth's 'something far more deeply interfused, Whose dwelling is the light of setting suns, . . . and in the mind of man', is a deeper and more permanent foundation on which to build a life and a life-sustaining art than any traditional mythology.

But the myths are still there, still make their appeal to something in the mind of man—something, it is true, considerably more shifting, considerably less deeply interfused than the great nameless Something of Wordsworth's poem, but still psychologically important. The contemporary man of letters finds himself confronted, as he prepares to write about Nature, by a fascinating problem—the problem of harmonizing, within a single work of art, the old, beloved raw materials, handed down to him by the myth-makers of an earlier time, with the new findings and hypotheses now pouring in upon him from the sciences of his own day.

Let us consider this problem in terms of a particular case. In this second half of the twentieth century what should a literary artist, writing in the English language, do about nightingales? The first thing to be remarked is that the spraying of English hedgerows with chemical weed-killers has wiped out most of their population of assorted caterpillars, with the result that caterpillar-eating nightingales (along with caterpillar-eating cuckoos and those ex-caterpillars, the butterflies) have now become rarities in a land where they were once the most widely distributed of poetical raw materials.

LITERATURE AND SCIENCE

There is subject matter here for a richly ramifying essay, a poem, at once lyrical and reflective, a long chapter in a Proustian novel. Thanks to science and technology we now have chemical sprays that kill the weeds in hedges. The sprays are used, the weeds are duly destroyed—and so is the biological basis of a long tradition of poetical feeling and poetical expression. Men must act, but should never forget that they are incapable of foreseeing the remoter consequences of their actions. No weeds, no caterpillars. No caterpillars, no Philomel with melody, no plaintive anthem or charming of magic casements. Our world is a place where nobody ever gets anything for nothing, where every gain in almost every field has to be paid for, either on the nail or in an indefinitely lengthy series of instalments.

Chemical sprays are not science's only contribution to the literary problem of the nightingale. Thanks to the bird watchers and the students of animal behaviour, we now know much more about the nightingale's song than was known in the past. The immortal bird (precariously *un*-immortal, as our recent experience with weed-killers has demonstrated) still sings, where the caterpillars are still sufficiently plentiful, its old, immemorially moving song. Darkling we listen,

While thou art pouring forth thy soul abroad
In such an ecstasy;

listen in the moonlight, while

thick the bursts come crowding through the leaves.

Again—thou hearest!

Eternal Passion!

Eternal pain!

LITERATURE AND SCIENCE

And, as we listen, the old myths come back to mind

Dost thou again behold,
Here, through the moonlight on this English grass,
The unfriendly palace in the Thracian wild?

Dost thou again peruse
With hot cheeks and sear'd eyes
The too clear web, and thy dumb Sister's shame?

Or else from the old Greek horror-story of crime, sexual scandal and miraculous interventions from on high, the listening poet may shift his attention to another beloved tradition. What he now hears is:

Perhaps the self-same song that found a path
Through the sad heart of Ruth, when, sick for home,
She stood in tears amid the alien corn.

A century after Keats and half a century after Matthew Arnold, Mr T. S. Eliot made use of the same traditional raw material of English poetical feeling and poetical expression. He wrote of Philomel by the barbarous king

So rudely forced; yet there the nightingale
Filled all the desert with inviolable voice,
And still she cries, and still the world pursues,
'Jug Jug' to dirty ears.

And how ingrainedly, how innately dirty those ears are! Sweeney's ears, Mrs Porter's ears, Rachel *née* Rabinovitch's ears. The nightingales, meanwhile,

The nightingales are singing near
The Convent of the Sacred Heart,

LITERATURE AND SCIENCE

And sang within the bloody wood
When Agamemnon cried aloud,
And let their liquid siftings fall
To stain the stiff dishonoured shroud.

We are back among the ancient tales of crime and sexual scandal and supernatural intervention. In Mr Eliot's nightingale-literature, the only novelties are the dirtiness of the listening ears and the proximity of the Convent of the Sacred Heart. Agamemnon and the king of Daulis; Sweeney and Blessed Marguerite-Marie Alacoque, modern squalor, ancient barbarism and baroque religiosity—it is with these mythological upper partials, these cultural harmonics and satirical undertones that the song of the immortal bird comes to a great contemporary poet. From a reading of 'The Waste Land' and 'Sweeney Among the Nightingales' one would never suspect that Mr Eliot is a contemporary of Eliot Howard and Konrad Lorenz. When he speaks of Philomel he speaks of her as Arnold and Keats had spoken—as a creature with human feelings, singing her song within a merely cultural frame of reference. By the nineteen-twenties, when Mr Eliot was writing these poems, the reasons why birds sing were at last clearly understood. Howard and his fellow ethologists had discovered what Philomel's outpourings signified, what was their purpose. Man is the measure of all things. How true—for us! But for nightingales, the measure of the nightingale-universe is nightingales; the measure of a tiger's world is, for tigers, simply tigers. That the ethologists have been able to recognize this truth and to act upon it represents a major triumph of the scientific method. Philomel, it turns out, is not Philomel, but her mate. And when the cock-nightingale sings, it is not in pain, not in

passion, not in ecstasy, but simply in order to proclaim to other cock-nightingales that he has staked out a territory and is prepared to defend it against all comers. And, what makes him sing at night? A passion for the moon, a Baudelairean love of darkness? Not at all. If he sings at intervals during the night it is because, like all the other members of his species, he has the kind of digestive system that makes him want to feed every four or five hours throughout the twenty-four. Between caterpillars, during these feeding times, he warns his rivals (Jug, Jug, Jug) to keep off his private property.

When the eggs are hatched and territorial patriotism ceases to be necessary, a glandular change within the cock-nightingale's body puts a stop to all singing. Eternal pain and passion, the inviolable voice and the outpourings of ecstasy, give place to a silence, broken only by an occasional hoarse croak.

To the twentieth-century man of letters this new information about a tradition-hallowed piece of poetic raw material is itself a piece of potentially poetic raw material. To ignore it is an act of literary cowardice. The new facts about nightingales are a challenge from which it would be pusillanimous to shrink. And what a challenge! The words of the tribe and of the Text Book must be purified into a many-meaning language capable of expressing simultaneously the truth about nightingales, as they exist in their world of caterpillars, endocrine glands and territorial possessiveness, and the truth about the human beings who listen to the nightingale's song. It is a strangely complex truth about creatures who can think of the immortal bird in strictly ornithological terms and who at the same time are overcome (in spite of ornithology, in spite of the ineradicable dirtiness of their ears) by the

LITERATURE AND SCIENCE

magical beauty of that plaintive anthem as it fades 'past the near meadows, over the still stream'. It is truth about creatures who know perfectly well that everything transient is *not* a symbol of something else, but a part of whose mind likes to hark back to Philomela and the horrible tale of crime and counter-crime, of incestuous rape and avenging murder. It is a truth, finally, about creatures, in whose minds, far more deeply interfused than any scientific hypothesis or even any archetypal myth, is the Something whose dwelling is everywhere, the essential Suchness of the world, which is at once immanent and transcendent—'in here' as the profoundest and most ineffable of private experiences and at the same time 'out there', as the mental aspect of the material universe, as the emergence into cosmic mind of the organization of an infinity of organizations, perpetually perishing and perpetually renewed.

38

Thought is crude, matter unimaginably subtle. Words are few and can only be arranged in certain conventionally fixed ways; the counterpoint of unique events is infinitely wide and their succession indefinitely long. That the purified language of science, or even the richer purified language of literature should ever be adequate to the givenness of the world and of our experience is, in the very nature of things, impossible. Cheerfully accepting the fact, let us advance together, men of letters and men of science, further and further into the ever expanding regions of the unknown.

SCIENCE, LIBERTY AND PEACE

I

‘IF THE ARRANGEMENT of society is bad (as ours is), and a small number of people have power over the majority and oppress it, every victory over Nature will inevitably serve only to increase that power and that oppression. This is what is actually happening.’

It is nearly half a century since Tolstoy wrote these words, and what was happening then has gone on happening ever since. Science and technology have made notable advances in the intervening years—and so has the centralization of political and economic power, so have oligarchy and despotism. It need hardly be added that science is not the only causative factor involved in this process. No social evil can possibly have only one cause. Hence the difficulty, in any given case, of finding a complete cure. All that is being maintained here is that progressive science is one of the causative factors involved in the progressive decline of liberty and the progressive centralization of power, which have occurred during the twentieth century.

Applied science touches the lives of individuals and societies at many different points and in a great variety of contexts, and therefore the ways in which it has increased the power of the few over the majority are correspondingly many and various. In the paragraphs that follow I shall enumerate the more obviously significant of these ways, shall indicate how and by what means applied science has contributed hitherto toward the centralization of power in the hands of a small ruling minority, and also how and by what means such tendencies may be resisted and ultimately, perhaps, reversed.

SCIENCE, LIBERTY AND PEACE

I. In the course of the past two or three generations science and technology have equipped the political bosses who control the various national states with unprecedentedly efficient instruments of coercion. The tank, the flame-thrower and the bomber—to mention but a few of these instruments—have made nonsense of the old techniques of popular revolt. At the same time the recent revolutionary improvements in the means of transport and communications have vastly strengthened the hands of the police. In his own peculiar way, Fouché was a man of first-rate abilities; but compared with the secret police force at the disposal of a modern dictatorship or even of a modern democracy, the instrument of oppression, which he was able to forge for Napoleon, was an absurdly clumsy piece of machinery. In the past, personal and political liberty depended to a considerable extent upon governmental inefficiency. The spirit of tyranny was always more than willing; but its organization and material equipment were generally weak. Progressive science and technology have changed all this completely. Today, if the central executive wishes to act oppressively, it finds an almost miraculously efficient machine of coercion standing ready to be set in motion. Thanks to the genius and co-operative industry of highly trained physicists, chemists, metallurgists and mechanical inventors, tyrants are able to dragoon larger numbers of people more effectively, and strategists can kill and destroy more indiscriminately and at greater distances, than ever before. On many fronts nature has been conquered; but, as Tolstoy foresaw, man and his liberties have sustained a succession of defeats.

Overwhelming scientific and technological superiority cannot be resisted on their own plane. In 1848 the sport-

SCIENCE, LIBERTY AND PEACE

ing gun was a match for the muskets of the soldiery, and a barricade made of overturned carts, sandbags and paving stones was a sufficient protection against cavalry and muzzle-loading cannon. After a century of scientific and technological progress no weapons available to the masses of the people can compete with those in the arsenals controlled by the ruling minority. Consequently, if any resistance is to be offered by the many to the few, it must be offered in a field in which technological superiority does not count. In countries where democratic institutions exist and the executive is prepared to abide by the rules of the democratic game, the many can protect themselves against the ruling few by using their right to vote, to strike, to organize pressure groups, to petition the legislature, to hold meetings and conduct press campaigns in favour of reform. But where there are no democratic institutions, or where a hitherto democratic government declines any longer to abide by the rules of the game, a majority which feels itself oppressed may be driven to resort to direct action. But since science and technology, in conquering nature have thereby enormously increased the military and police power of the ruling few, this direct action cannot hope for a successful outcome, if it is violent; for in any armed conflict, the side which has the tanks, planes and flame-throwers cannot fail to defeat the side which is armed at the very best only with small arms and hand grenades.

Is there any way out of the unfavourable political situation in which, thanks to applied science, the masses now find themselves? So far only one hopeful issue has been discovered. In South Africa and, later, in India, Gandhi and his followers were confronted by an oppressive government armed with overwhelming military might.

SCIENCE, LIBERTY AND PEACE

Gandhi, who is not only an idealist and a man of principle, but also an intensely practical politician, attempted to cope with this seemingly desperate situation by organizing a non-violent form of direct action, which he called *satyagraha*. For a full account of the methods and results of *satyagraha* the reader is referred to *War without Violence* by Krishnalal Shridharani (New York, 1939). Here it is only necessary to state that the method achieved a number of striking successes against odds which, from a military point of view, were overwhelmingly great. To those who think that the record of Gandhi's achievements is irrelevant to the historical and psychological situation of the industrial West, Mr. Shridharani makes the following answer :

My contact with the Western world has led me to think that, contrary to popular belief, *satyagraha*, once consciously and deliberately adopted, has more fertile fields in which to grow and flourish in the West than in the Orient. Like war, *satyagraha* demands public spirit, self-sacrifice, organization and discipline for its successful operation, and I have found these qualities displayed in Western communities more than in my own. Perhaps the best craftsmen in the art of violence may still be the most effective wielders of non-violent direct action. It is but a question, in the words of William James, of 'opinion-making men seizing historic opportunities.'

It is often argued that *satyagraha* cannot work against an organization whose leaders are prepared to exploit their military superiority without qualm or scruple. And of course this may very well be the case. No more than any other form of political action, violent or otherwise, can *satyagraha* guarantee success. But even though,

SCIENCE, LIBERTY AND PEACE

against an entirely ruthless and fanatical opponent, non-co-operation and what Thoreau called 'civil disobedience,' coupled with a disciplined willingness to accept and even to court sacrificial suffering, may prove unavailing, the resulting situation could not be, materially, any worse than it would have been if the intolerable oppression had been passively accepted or else resisted unavailingly by force; while, psychologically and morally, it would in all probability be very much better—better for those participating in the *satyagraha*, and better in the eyes of spectators and of those who merely heard of the achievement at second hand.

In the years ahead it seems possible that *satyagraha* may take root in the West—not primarily as the result of any 'change of heart,' but simply because it provides the masses, especially in the conquered countries, with their only practicable form of political action. The Germans of the Ruhr and the Palatinate resorted to *satyagraha* against the French in 1923. The movement was spontaneous; philosophically, ethically and organizationally, it had not been prepared for. It was for this reason that it finally broke down. But it lasted long enough to prove that a Western people—and a people more thoroughly indoctrinated with militarism than any other—was perfectly capable of non-violent direct action, involving the cheerful acceptance of sacrificial suffering. Similar movements of *satyagraha* (more conscious of themselves this time, and better prepared for) may again be initiated among the masses of conquered Germany. The impracticability of any other kind of political action makes it very possible that this will happen sooner or later. It would be one of the happier ironies of history if the nation which produced Clausewitz and Bernhardt and

SCIENCE, LIBERTY AND PEACE

Hitler were to be forced by circumstances to become the first large-scale exponent in the West of that non-violent direct action which has become, in this age of scientific progress, humanity's only practical substitute for hopeless revolution and self-stultifying or suicidal war.

2. The pen and the voice are at least as mighty as the sword; for the sword is wielded in obedience to the spoken or the written word. Progressive technology has strengthened the powers that be by providing them not only with bigger and better instruments of coercion, but also with instruments of persuasion incomparably superior to those at the disposal of earlier rulers. The rotary press and, more recently, the radio have contributed greatly to the concentration of political and economic power. James Mill believed that, when everybody had learned to read, the reign of reason and democracy would be assured for ever. But in actual historical fact the spread of free compulsory education, and, along with it, the cheapening and acceleration of the older methods of printing, have almost everywhere been followed by an increase in the power of ruling oligarchies at the expense of the masses. The reasons for this are obvious. A newspaper combining attractiveness with cheapness cannot be produced unless it is subsidized either by advertisers (that is to say, the people who control centralized finance and large-scale, mass-producing and mass-distributing industry), or by some organization desirous, for its own purposes, of influencing public opinion, or by the central government. In countries where the press is said to be free, newspapers are subsidized primarily by advertisers, and to a lesser extent by political parties, financial or professional groups. In countries where the press is not free, newspapers are subsidized by the central government.

SCIENCE, LIBERTY AND PEACE

The man who pays the piper always calls the tune. In capitalist democracies the popular press supports its advertisers by inculcating the benefits of centralized industry and finance, coupled with as much centralized government as will enable these institutions to function at a profit. In totalitarian states all newspapers preach the virtues of governmental omnipotence, one-party politics and state control of everything. In both cases progressive technology has strengthened the hands of the local bosses by providing them with the means of persuading the many that concentration of political and economic power is for the general benefit.

What is true of the press is equally true of the radio. Spoken words are more exciting than words printed on wood pulp. In the past a great orator could reach, at the most, only a few thousand listeners. Today, thanks to applied science, a dictator with a gift of the gab is able to pour his emotionally charged evangel into the ears of tens of millions. What Mark Antony could do to the mob assembled round Caesar's corpse, his modern counterpart can do to entire nations. Never have so many been so much at the mercy of so few.

Undesirable propaganda will not cease until the persons who pay for propaganda either change their minds, or are replaced by other persons willing to pay for something else. Meanwhile there is no remedy for the evil except personal self-denial. Reading newspapers and listening to the radio are psychological addictions; and psychological addictions, like the physiological addictions to drugs, tobacco and alcohol, can only be put an end to by a voluntary effort on the part of the addict. So long as people yield to the craving to read about murders and divorces and to look at the comic strips, or to listen

SCIENCE, LIBERTY AND PEACE

to soap operas and swing music, they must expect to be influenced by the propaganda which always accompanies these habit-forming stimuli. A questionnaire on reading habits was recently addressed by the heads of a New York labour union to its membership. Among the questions asked were: What newspaper do you regularly read? and what newspaper do you consider the least trustworthy and most untruthful? Sixty per cent. of the membership agreed that newspaper X was the most untruthful sheet in the New York area, but over forty per cent. admitted to making it their daily reading—because of its superior comic strips and more violent sensationalism. As usual, it is a case of *video meliora proboque; deteriora sequor*—I see the better and I approve; but the worse is what I pursue. Under the present dispensation, nothing but self-denial on the part of readers can diminish the influence of newspaper X. Continued indulgence in psychological addictions has to be paid for, and the price is undesirable propaganda.

3. By supplying the ruling oligarchy with more effective instruments of coercion and persuasion, applied science has contributed directly to the centralization of power in the hands of the few. But it has also made important indirect contributions to the same end. It has done this in two ways; first, by introducing over ever larger areas of the industrial and agricultural economy the methods of large-scale mass production and mass distribution; second, by creating, through its very progressiveness, an economic and social insecurity which drives all those concerned, owners and managers no less than workers, to seek the assistance of the national state. Let us now consider these two power-centralizing factors in greater detail.

SCIENCE, LIBERTY AND PEACE

(a) In applying the results of disinterested scientific research, inventors and technicians have paid more attention to the problem of equipping large concerns with the expensive machinery of mass production and mass distribution than to that of providing individuals or co-operating groups with cheap and simple, but effective, means of production for their own subsistence and for the needs of a local market. The reason for this is that there has been more money in working for the mass producers and mass distributors; and the mass producers and mass distributors have had more money because financiers have seen that there was more profit for them, and more power, in a centralized than in a decentralized system of production.

Here, in parenthesis, let us note that concentration of financial power preceded the scientific revolution of the eighteenth and nineteenth centuries and was largely responsible for making our industrial civilization the hateful thing it was and, for the most part, still is. Throughout Europe, land and natural resources were not owned outright by the people, represented by a multitude of small-holders; nor were they the property of a sovereign, leasing to small tenants and spending the rent (which is the monetary expression of the social value of land) for social purposes. The best part of the land and its natural resources was the monopoly of a small class of landlords, who appropriated the social values of what should, quite obviously, have been everybody's property, to their own private use. Hence the early centralization of financial power—a power that was used to exploit the new technological discoveries for the benefit, not of individual small producers or co-operating groups, but for that of the class which alone possessed accumulations of money.

SCIENCE, LIBERTY AND PEACE

Centralized finance begot centralized industry, and in due course the profits of centralized industry increased the power of centralized finance, so that it was able to proceed ever further in the direction of completely centralized production and distribution.

The centralizing of industrial capacity in big mass-producing factories has resulted in the centralization of a large part of the population in cities and in the reduction of ever-increasing numbers of individuals to complete dependence upon a few private capitalists and their managers, or upon the one public capitalist, the state, represented by politicians and working through civil servants. So far as liberty is concerned, there is little to choose between the two types of boss. Up to the present, state-controlled enterprises have been closely modelled upon those of capitalist big business. Nationalization has not stopped short at land and natural resources, nor have the land and natural resources been nationalized with the purpose of giving individuals or co-operating groups free access to the means of small-scale production, personal liberty and self-government. On the contrary, the objects nationalized include, besides land and natural resources, the tools of production, and that nationalization has been undertaken with a view to strengthening the state (that is to say, the politicians momentarily in power) against its subjects and not at all with the purpose of liberating individual men and women from economic dependence upon bosses. But economic dependence upon bosses is always bad, because, quite obviously, it is not easily reconcilable with local and professional self-government or with civil and personal liberty. Democratic institutions are likely to work best at times and in places where at least a good part of the citizens have access to enough

SCIENCE, LIBERTY AND PEACE

land and possess sufficient tools and professional skill to be able to provide for their subsistence without recourse to financially potent private capitalists or to the government. Where, as in the contemporary Western world, great numbers of the citizens own nothing (not even, in many cases, a skill, since the operation of semi-automatic machines does not require a skill), personal liberty and political and civil rights are to a more or less considerable extent dependent upon the grace of the capitalistic or national owners and managers of the means of production and distribution, and upon their willingness to abide by the rules of the democratic game. To forward their interests and to protect themselves against oppression, propertyless workers combine in trade unions. These have done much to bridle the ambition and covetousness of capitalists and to improve the conditions of labour. But trade unions are as subject to gigantism and centralization as are the industries to which they are related. Consequently it happens all too frequently that the masses of unionized workers find themselves dependent upon, and subordinated to, two governing oligarchies—that of the bosses and that of the union leaders. Over the first they have no control at all, except by strike and the threat of strike; over the second their control is at best remote and rather shadowy. Self-government, which is the very essence of democratic freedom, is more or less completely absent from their professional lives. This is ultimately due, as we have seen, to propertylessness and consequent dependence upon the private or public owners and managers of the means of mass production and mass distribution; and propertylessness is due in its turn to (among other things) the progress of applied science—a progress which, under the auspices of centralized finance,

has hitherto favoured mass production at the expense of production on a small scale for personal or co-operative use, or to supply a local market.

In the most highly industrialized countries, applied science and its ally, and master, centralized finance, have profoundly changed the traditional pattern of agricultural life. Thus, in the United States, the percentage of the population making its living from the land has been reduced in recent years to only a fifth of the total. Meanwhile the size of individual holdings of land has tended to increase, as powerful corporations add field to field in the effort to exploit mechanized farming to its economic limit. Small-scale farmers, who used to be primarily concerned with subsistence, secondarily with a cash crop, have been largely replaced by men whose primary concern is with cash crops and who use the cash so earned to buy 'nationally advertised,' processed and denatured foods at the grocer's.

In Russia the process of centralizing and consolidating the control of land and of industrializing agricultural production has been carried out by government decree and by means of the liquidation of a whole class of society. It would appear, however, that a measure of small-scale private ownership, or quasi-ownership, has had to be reintroduced in order to increase agricultural efficiency by improving the morale of the workers.

(b) Among the ordinary results of the rapid progress of applied science are technological unemployment and the sudden and unexpected necessity of changing long-established habits of agricultural and industrial production. When too rapid, changes of position or state are very disturbing to living organisms, sometimes even fatal. That is why, when we get out of a plane in mid-air,

SCIENCE, LIBERTY AND PEACE

we use a parachute, why, when we take a Turkish bath, we do not plunge immediately into the hottest chamber. Analogously, social, economic and political changes can take place too rapidly and too frequently for human well-being. A highly progressive technology entails incessant and often very rapid and startling changes of economic, political and ethical state; and such changes tend to keep the societies subjected to them in a chronically uncomfortable and unstable condition. Some day, perhaps, social scientists will be able to tell us what is the optimum rate of change, and what the optimum amount of it at any one time. For the present, Western societies remain at the mercy of their progressive technologies, to the intense discomfort of everybody concerned. Man as a moral, social and political being is sacrificed to *homo faber*, or man the smith, the inventor and forger of new gadgets.

And meanwhile, of course, technological unemployment is always with us; for every labour-saving device, every substitution of a new and more efficient technique for an older and less efficient one, results in a local and temporary diminution of the labour force. In the long run the persons displaced, as the result of technological advance, may find themselves reabsorbed by other industries or even (since increased efficiency results in lowered prices, greater demand and an expansion of production sufficient, in some cases, to offset the original technological unemployment) by the industry from which they were discharged. But what may happen in the long run is of little interest to propertyless persons who are compelled by hunger and the elements to do their living exclusively in the short run. For such persons the chief consequence of progressive science is a chronic social and economic insecurity.

SCIENCE, LIBERTY AND PEACE

Here, as in an earlier paragraph, it is necessary to stress the fact that the progress of applied science is not the only causative factor involved. Mass unemployment and periodical slumps have a variety of interlocking causes—meteorological, financial and psychological causes as well as those connected with science and technology. Concerning the relative importance of these factors the experts are not yet agreed. Many theories of slumps and unemployment have been formulated, each of which emphasizes one of the known causative factors at the expense of all the rest. None of these theories is universally accepted; but all of them—and this, for our present purpose, is the important point—are agreed that technological unemployment is a reality and that the progress of applied science does in fact play an important part in creating the economic and social insecurity which is the plague of modern industrial societies.

In the capitalist countries the nature of the monetary and financial systems has been such that, whenever a boom gets under way, the issuers of credit are compelled by the traditional rules of banking to withdraw credit and so to convert the boom into a slump. At the same time the owners of mass-producing industry are compelled by the rules of the game of profit-making to practise what Thorstein Veblen used to call 'capitalist sabotage'—in other words, they are compelled by the necessity of making profits to prevent their managers from producing as many goods and at as cheap a rate as they are technically equipped to do. In both cases the result of following the traditional rules is an accentuation of the social and economic insecurity normally resulting from technological progress. State socialists hold that the remedy for these evils can be found only in the nationalization of banking,

SCIENCE, LIBERTY AND PEACE

land and industry—in other words, in the complete and final centralization of economic as well as political power in the hands of the currently ruling politicians and their managers. But power is in its essence expansive, and cannot be curbed except by other powers of equal or at least comparable magnitude. Under a regime of state socialism there would be no power systems within a community capable of opposing any serious resistance to the politically and economically almighty executive. The political bosses and civil servants in control of the state would themselves be controlled by nothing stronger than a paper constitution. In cases where state socialism succeeds capitalist democracy by non-violent, constitutional means, the rules of the political game are likely to remain, in many respects, identical with those prevailing under the older regime. For as long as the new system is administered by men brought up under democratic traditions, the constitutional rules will probably be observed. But when these men are succeeded by a new generation, born and brought up in a society dominated by the omnipotent state, what then? Only the most ingenuously optimistic, the most wilfully blind to the facts of history and psychology, can believe that paper guarantees of liberty—guarantees wholly unsupported by the realities of political and economic power—will be scrupulously respected by those who have known only the facts of governmental omnipotence on the one hand and, on the other, of mass dependence upon, and consequently subservience to, the state and its representatives.

We see, then, that technological progress results in economic and social insecurity, and that this insecurity is greatly aggravated, in the capitalist countries, by the necessity of abiding by the traditional rules of private

SCIENCE, LIBERTY AND PEACE

banking, financing and mass production. By nationalizing, or at the least by rigidly controlling, industry, agriculture and banking, the state could probably get rid of periodical depressions and would be in a position to mitigate, by financial and political measures, the worst consequences of scientific progress. In this way the advantages of centralized finance, mass-producing industry and quasi-industrial agriculture could be reconciled with social and economic security for the masses. But everything has its price, and it seems unlikely that security achieved in this way could for long co-exist with that liberty under law which, as Acton was never tired of insisting, is the end of all political action, all social and economic arrangements.

At the present time the horrors of insecurity, as exemplified above all in mass unemployment, have impressed themselves so deeply upon the popular mind that, if offered the choice between liberty and security, most people would almost unhesitatingly vote for security. Similar situations have occurred at other periods of history. Thus, in the years which witnessed the final disintegration of the Roman Empire, the insecurity of life and property was such that many hitherto free peasants and yeomen voluntarily made over their land and even their persons to the nearest great lord, in exchange for his protection. It was better, they felt, to be the serf or even the domestic slave of a powerful noble than to be free, but at the mercy of bandits, barbarians and the men-at-arms of other hereditary magnates. The sources of our present insecurity are not the same as were the sources of the insecurity of fifteen hundred years ago; but in both cases the reaction to insecurity is identical—namely, a general wish to exchange freedom for protection, inde-

pendence for guaranteed subsistence in the service of the holders of great power. But great power invariably exercises a corrupting influence on those who wield it; and when, in due course, the tyranny of the bosses in control of the omnipotent state becomes unbearable, the masses who now pine for security will begin to pine even more ardently for liberty. That they will be able to extort liberty from a ruling minority equipped by science with the very latest in self-propelled flame-throwers and atomic missiles seems in the highest degree unlikely. It is in *satyagraha*, or non-violent direct action, that the only hope of future revolutions resides. Meanwhile there is no question, in the contemporary world, of any popular movement in favour of liberty. On the contrary, the masses are everywhere clamouring for ever greater governmental control of everything. Nor are these demands exclusively confined to the masses. The owners and managers of the various capitalist systems of production are also victims of the general insecurity. They too would like a measure of government control—enough control to guarantee profits, but not so much, of course, as to constitute expropriation or nationalization.

Is there any way in which the material advantages of progressive technology can be combined not only with security, but also with freedom? My own view, which is essentially that of the Decentralists, is that, so long as the results of pure science are applied for the purpose of making our system of mass-producing and mass-distributing industry more expensively elaborate and more highly specialized, there can be nothing but ever greater centralization of power in ever fewer hands. And the corollary of this centralization of economic and political power is the progressive loss by the masses of their civil

SCIENCE, LIBERTY AND PEACE

liberties, their personal independence and their opportunities for self-government. But here we must note that there is nothing in the results of disinterested scientific research which makes it inevitable that they should be applied for the benefit of centralized finance, industry and government. If inventors and technicians so chose, they could just as well apply the results of pure science for the purpose of increasing the economic self-sufficiency and consequently the political independence of small owners, working either on their own or in co-operative groups, concerned not with mass distribution, but with subsistence and the supply of a local market. The sabbath was made for man, not man for the sabbath; and the same is true of applied science. Human beings have certain physical and psychological wants. They require food, clothing and shelter; and, for moral and mental health, they need to be given the opportunity to develop their latent potentialities to the fullest degree compatible with the freedom and well-being of others. And beyond these primary psychological needs lies man's spiritual need—the need, in theological language, to achieve his Final End, which is the unitive knowledge of ultimate Reality, the realization that Atman and Brahman are one, that the body is a temple of the Holy Ghost, that Tao or the Logos is at once transcendent and immanent.

Now it seems pretty obvious that man's psychological, to say nothing of his spiritual, needs cannot be fulfilled unless, first, he has a fair measure of personal independence and personal responsibility within and toward a self-governing group, unless, secondly, his work possesses a certain aesthetic value and human significance, and unless, in the third place, he is related to his natural environment in some organic, rooted and symbiotic way. But in

SCIENCE, LIBERTY AND PEACE

modern industrial societies vast numbers of men and women pass their whole lives in hideous cities, are wholly dependent for their livelihood upon a capitalistic or governmental boss, have to perform manual or clerical work that is repetitive, mechanical and intrinsically meaningless, are rootless, propertyless and entirely divorced from the world of nature, to which, as animals, they still belong and in which, as human beings, they might (if they were sufficiently humble and docile) discover the spiritual Reality in which the whole world, animate and inanimate, has its being. The reason for this dismal state of things is the progressive application of the results of pure science for the benefit of mass-producing and mass-distributing industry, and with the unconscious or conscious purpose of furthering centralization of power in finance, manufacture and government.

But now let us suppose that those who make it their business to apply the results of pure science to economic ends should elect to do so, not primarily for the benefit of big business, big cities and big government, but with the conscious aim of providing individuals with the means of doing profitable and intrinsically significant work, of helping men and women to achieve independence from bosses, so that they may become their own employers, or members of a self-governing, co-operative group working for subsistence and a local market. Suppose, I repeat, that this were henceforward to become the acknowledged purpose guiding the labours of inventors and engineers. Seconded by appropriate legislation, this differently orientated technological progress would result, not as at present in the further concentration of power and the completer subordination of the many to the few, but in a progressive decentralization of population, of accessi-

SCIENCE, LIBERTY AND PEACE

bility of land, of ownership of the means of production, of political and economic power. Ralph Borsodi's studies have shown that mass-producing and mass-distributing methods are technologically justified in about one-third of the total production of goods. In regard to the remaining two-thirds, the economies effected by mass-production are offset by the increased costs involved in mass distribution over great areas, so that local production by individuals or co-operating groups, working for subsistence and a neighbourhood market, is more economical than mass production in vast centralized factories. And to these economic advantages of decentralization must be added the social advantages of a more humanly satisfying life for more people, a greater measure of genuine self-governing democracy and a blessed freedom from the silly or pernicious adult education provided by the mass producers of consumer goods through the medium of advertisements.

4. The continuous advance of science and technology has profoundly affected the prevailing mental climate. The basic postulates of thought have been changed, so that what to our fathers seemed obviously true and important strikes us as either false or negligible and beside the point. Let us consider a few of the more significant of these changes and their effects upon the social and political life of our times.

(a) Unlike art, science is genuinely progressive. Achievement in the fields of research and technology is cumulative; each generation begins at the point where its predecessor left off. Furthermore, the results of disinterested research were from the first applied in such a way that the upper and middle classes of all industrialized societies found themselves becoming steadily richer and

richer. It was, therefore, only to be expected that the professional thinkers who sprang from these classes, and who were familiar with the methods and achievements of science, should have based upon the facts of technological and economic progress a general theory of human life. The world, they affirmed, was becoming materially, intellectually and morally better and better, and this amelioration was in some way inevitable. The theory of progress—a theory that soon became a dogma, indeed an axiom of popular thought—was novel and, from an orthodox Christian point of view, heretical. For orthodoxy, man was a fallen being. Humanity if not actively deteriorating, was statically bad, with a badness which only grace in co-operation with the individual's free will could possibly mitigate. In illustration of this, let us consider how the thirteenth century was regarded by those who lived through it, and how it is regarded by modern historians. For the latter it seems one of the most glorious periods in European history; the former were unanimous (as Professor Coulton has shown) in regarding it as an age of peculiar wickedness and manifest degeneracy. Even in the age of Queen Elizabeth thoughtful men were still talking of humanity's decline. It was not until the late seventeenth century (the age of the rise of modern science) that the note of bumptious self-congratulation began to be sounded, not until the eighteenth and nineteenth centuries that the dogma of inevitable progress became an unquestioned article of popular faith.

The belief in all-round progress is based upon the wishful dream that one can get something for nothing. Its underlying assumption is that gains in one field do not have to be paid for by losses in other fields. For the

SCIENCE, LIBERTY AND PEACE

ancient Greeks, *hubris*, or overweening insolence, whether directed against the gods, or one's fellow-men, or nature, was sure to be followed, sooner or later, in one way or another, by avenging Nemesis. Unlike the Greeks, we of the twentieth century believe that we can be insolent with impunity.

So intense is our faith in the dogma of inevitable progress that it has survived two world wars and still remains flourishing in spite of totalitarianism and the revival of slavery, concentration camps and saturation bombing.

Faith in progress has affected contemporary political life by reviving and popularizing, in an up-to-date, pseudo-scientific and this-worldly form, the old Jewish and Christian apocalypticism. A glorious destiny awaits mankind, a coming Golden Age, in which more ingenious gadgets, more grandiose plans and more elaborate social institutions, will somehow have created a race of better and brighter human beings. Man's Final End is not in the eternal timeless Now, but in a not too distant utopian future. In order to secure the peace and happiness of their great-great-grandchildren, the masses ought to accept and their rulers need feel no qualms in imposing, any amount of war and slavery, of suffering and moral evil, in the present. It is a highly significant fact that all modern dictators, whether of the Right or of the Left, talk incessantly about the golden Future, and justify the most atrocious acts here and now, on the ground that they are means to that glorious end. But the one thing we all know about the future is that we are completely ignorant of what is going to happen, and that what does in fact happen is often very different from what we anticipated. Consequently any faith based upon hypothetical occurrences a long time hence must always, in the very

SCIENCE, LIBERTY AND PEACE

nature of things, be hopelessly unrealistic. In practice, faith in the bigger and better future is one of the most potent enemies to present liberty; for rulers feel themselves justified in imposing the most monstrous tyrannies on their subjects for the sake of the wholly imaginary fruits which these tyrannies are expected (only an implicit faith in progress can say why) to bear some time, let us say, in the twenty-first or twenty-second century.

(b) As theory, pure science is concerned with the reduction of diversity to identity. As a praxis, scientific research proceeds by simplification. These habits of scientific thought and action have, to a certain extent, been carried over into the theory and practice of contemporary politics. Where a centralized authority undertakes to make plans for an entire society, it is compelled by the bewildering complexity of the given facts to follow the example of the scientific experimenter, who arbitrarily simplifies his problem in order to make it manageable. In the laboratory this is a sound and entirely justifiable procedure. But when applied to the problems of human society, the process of simplification is a process, inevitably, of restraint and regimentation, of curtailment of liberty and denial of individual rights. This reduction of human diversity to a military and quasi-mechanical identity is achieved by propaganda, by legal enactments and, if necessary, by brute force—by the imprisonment, exile or liquidation of those persons, or those classes, who persist in their perverse desire to remain themselves and are obstinate in their reluctance to conform to the pattern which the political and economic bosses find it, at the moment, most convenient to impose. Philosophically, this ironing out of individual idiosyncrasies is held to be respectable, because it is analogous to what is done by

SCIENCE, LIBERTY AND PEACE

scientists, when they arbitrarily simplify an all too complex reality, so as to make nature comprehensible in terms of a few general laws. A highly organized and regimented society, whose members exhibit a minimum of personal peculiarities, and whose collective behaviour is governed by a single master plan imposed from above, is felt by the planners and even (such is the power of propaganda) by the plannees to be more 'scientific', and therefore better, than a society of independent, freely co-operating and self-governing individuals.

(c) The first step in this simplification of reality, without which (since human minds are finite and nature is infinite) scientific thought and action would be impossible, is a process of abstraction. Confronted by the data of experience, men of science begin by leaving out of account all those aspects of the facts which do not lend themselves to measurement and to explanation in terms of antecedent causes rather than of purpose, intention and values. Pragmatically they are justified in acting in this odd and extremely arbitrary way; for by concentrating exclusively on the measurable aspects of such elements of experience as can be explained in terms of a causal system they have been able to achieve a great and ever increasing control over the energies of nature. But power is not the same thing as insight and, as a representation of reality, the scientific picture of the world is inadequate, for the simple reason that science does not even profess to deal with experience as a whole, but only with certain aspects of it in certain contexts. All this is quite clearly understood by the more philosophically minded men of science. But unfortunately some scientists, many technicians and most consumers of gadgets have lacked the time and the inclination to examine the philosophical foundations and

SCIENCE, LIBERTY AND PEACE

background of the sciences. Consequently they tend to accept the world picture implicit in the theories of science as a complete and exhaustive account of reality; they tend to regard those aspects of experience which scientists leave out of account, because they are incompetent to deal with them, as being somehow less real than the aspects which science has arbitrarily chosen to abstract from out of the infinitely rich totality of given facts. Because of the prestige of science as a source of power, and because of the general neglect of philosophy, the popular *Weltanschauung* of our times contains a large element of what may be called 'nothing-but' thinking. Human beings, it is more or less tacitly assumed, are nothing but bodies, animals, even machines; the only really real elements of reality are matter and energy in their measurable aspects; values are nothing but illusions that have somehow got themselves mixed up with our experience of the world; mental happenings are nothing but epiphenomena, produced by and entirely dependent upon physiology; spirituality is nothing but wish fulfilment and misdirected sex; and so on. The political consequences of this 'nothing-but' philosophy are clearly apparent in that widespread indifference to the values of human personality and human life which are so characteristic of the present age. Within the past thirty years, this indifference has expressed itself in a number of dangerous and disquieting ways. We have witnessed, first of all, the wholesale revival of slavery in its worst and most inhuman forms—slavery imposed upon political heretics living under the various dictatorships, slavery imposed upon whole classes of conquered populations, slavery imposed upon prisoners of war. Next, we note the increasing indiscriminateness of slaughter during war-

SCIENCE, LIBERTY AND PEACE

time. Area bombing, saturation bombing, rocket bombing, bombing by atomic missiles—the indiscriminateness has steadily increased throughout the Second World War, until now no nation even makes a pretence of observing the traditional distinction between civilians and combatants, innocent and guilty, but all devote themselves methodically and scientifically to general massacre and wholesale destruction. Other practical consequences of our 'nothing-but' philosophies of life are the employment by civilized people, with a high standard of scientific and technological training, of torture, human vivisection and the systematic starvation of entire populations. And finally there is the phenomenon of forced migration—the removal at the point of the bayonet of millions of men, women and children from their homes to other places, where most of them will die of hunger, exposure and disease.

Unrealistic beliefs tend to result in foolish or morally evil actions; and such wrong beliefs cannot be got rid of, except by teaching right, or at least less erroneous, beliefs. If the ministers of the various sects and religions would abandon sentimentality and superstition, and devote themselves to teaching their flocks that the Final End of man is not in the unknowable utopian future, but in the timeless eternity of the Inner Light, which every human being is capable, if he so desires, of realizing here and now, then the myth of progress would lose its harmfulness as a justifier of present tyranny and wrongdoing. If scientists and technicians could be persuaded to read, for example, the essays in Edward Carpenter's *Civilization, Its Cause and Cure*, together with Professor Burt's *Metaphysical Foundations of Modern Science* and the speculative writings of Sir Arthur Eddington, the dis-

SCIENCE, LIBERTY AND PEACE

astrous notion that the contemporary scientific world picture is a complete representation of reality, and the no less disastrous habit of 'nothing-but' evaluations of social and psychological facts, might perhaps be eliminated, to the great advantage of suffering humanity. But *quis custodiet custodes?*—who is going to guard the guardians of our civilization, and who is going to teach its teachers? Our basic trouble is that, in spite of everything that has happened, everybody thinks he is right. In the past, despots committed the crimes that despots always do commit—but committed them with a conscience that was sometimes distinctly uneasy. They had been brought up as Christians, as Hindus, as Moslems or Buddhists, and in the depths of their being they knew that they were doing wrong, because what they were doing was contrary to the teachings of their religion. Today the political boss has been brought up in our more enlightened and scientific environment. Consequently he is able to perpetrate his outrages with a perfectly clear conscience, convinced that he is acting for humanity's highest good—for is he not expediting the coming of the glorious future promised by Progress? is he not tidying up a messily individualistic society? is he not doing his utmost to substitute the wisdom of experts for the foolishness of men and women who want to do what they think (how erroneously, since of course they are not experts!) is best for them? And then there are the pastors and the school-masters. They have their Ph.D.s and their D.D.s, their academic positions and their cures of souls, their habits of authority and their high perches in the pulpit or on the lecture platform. Why should they change their long-established habits and the hallowed traditions of the organizations of which they are the living pillars? The

SCIENCE, LIBERTY AND PEACE

most important lesson of history, it has been said, is that nobody ever learns history's lessons. The enormous catastrophes of recent years have left the survivors thinking very much as they thought before. A horde of Bourbons, we return to what we call peace, having learned nothing and forgotten nothing—forgotten nothing, except, of course, the causes of war, which (whatever our intentions and our well-worded ideals) we do everything in our power to perpetuate.

2

IN A WORLD where the concentration of economic power is advantageous to the ruling minority, it is only natural that the results of disinterested scientific research should be applied in such a way as to foster large-scale mass production and mass distribution. And in a world where nationalism is taken for granted, and where the values of nationalism are held to be supreme, it is only natural that these same results should be applied to the end of producing and continually improving the instruments of war. Because it paid them to do so, men of science, inventors and engineers have worked to build up a system of centralized industry; and because, as nationalists, they thought it was their duty (and also, it must be added, because the duty was often a very profitable one), they have worked to produce such marvels of technological ingenuity as tanks, bombers, flame-throwers and atomic missiles.

‘Nationality,’ wrote Lord Acton in 1862, ‘does not aim either at liberty or prosperity, both of which it sacrifices to the imperative necessity of making the nation the mould and measure of the state. Its course will be marked with material as well as moral ruin.’ Acton’s prophecy is still in the terrible process of fulfilment. The material havoc wrought by applied science in the service of nationalism is such that it will take a generation to repair the damage. For many millions of men, women and especially children, the moral ruin caused by the war is irreparable; to the end of their lives they are doomed to remain psychologically warped, crippled and stunted. And these, of course, are not the only gifts of the nationalism which

SCIENCE, LIBERTY AND PEACE

(having repudiated all belief in the fatherhood of God and the brotherhood of man) we have set up as our idolatrous religion. The world is parcelled out into some fifty-odd administrative units, calling themselves nations. In each of these nations there is a state religion—namely, the worship of the nation regarded as the supreme value, or God. To be a worshipper of one of the fifty-odd national Molochs is, necessarily and automatically, to be a crusader against the worshippers of all the other national Molochs. Nationalism leads to moral ruin because it denies universality, denies the existence of a single God, denies the value of the human being as a human being; and because, at the same time, it affirms exclusiveness, encourages vanity, pride and self-satisfaction, stimulates hatred and proclaims the necessity and the rightness of war. The fatal consequences of nationalism have been demonstrated again and again in the course of history. Consider, for example, the civilization of ancient Greece—the highest, in many respects, ever achieved in the Western world. After only a brief life it perished, self-destroyed by nationalism. Each city-state worshipped itself and consequently hated and despised its neighbours. The Greek world of the great poets, artists and philosophers was chronically in a state of civil war. In the end it bled to death, the victim of idolatrous and separatist patriotism. Fortunately, the Macedonians were at hand to take over.

The modern world differs from that of ancient Greece in degree and scale, not in kind. What separatist patriotism did for the inhabitants of a few thousand square miles in the eastern Mediterranean, it is doing today for the population of the entire planet. As Athens and Sparta died of idolatry and flag-waving and jingoism, so we shall die of idolatry and flag-waving and jingoism. But whereas

SCIENCE, LIBERTY AND PEACE

the technologists at the service of the various Greek nationalisms had got no further than chariots and javelins, the technologists at the service of our fifty-odd self-worshipping administrative units have given us bombers that can fly non-stop for eight thousand miles, incendiaries that nobody can put out, and atomic missiles that are guaranteed to do to whole cities what a quart of boiling water does to an ants' nest.

'Lead us not into temptation.' The presence of this phrase in the Lord's Prayer reveals its author's profoundly realistic appreciation of human nature. Why should we pray that we may not be led into temptation? For the excellent reason that, as all experience proves, whenever temptations to evil are sufficiently strong and sufficiently frequent, men and women generally succumb to them. The existence of powerful armaments constitutes for their possessors a standing temptation to resort to violence. *Si vis bellum, para bellum*: and when the preparations for war are carried on with all the resources of progressive science and technology, the temptation to aggression, to the defence or consolidation of legitimate interests, to the realization of a manifest destiny (the names and justifications vary, but the nature of the consequent war remains the same), becomes progressively more intense, until at some critical moment—the moment when nation X feels certain of being, in some strategically significant way, better armed than nations Y and Z—it turns into a categorical imperative, a divine command to go to war for the greater glory of the nation-god. Nor is this the only temptation to present itself. Recent progress in the applied science of armament-making has been a progress in the development of weapons that will destroy more indiscriminately at greater distances. High explosives

SCIENCE, LIBERTY AND PEACE

and incendiaries, the heavy bomber and the jet-propelled robot plane, the rocket and finally the atomic missile—taken together these constitute a powerful temptation to ignore the traditional rules of war and to obliterate wholesale entire civilian populations and their dwellings. To this temptation all the belligerents in the Second World War succumbed. And so long as governments and manufacturers continue to subsidize research into the science and technology of armaments, these temptations will remain, irresistibly beckoning to nationalistic power lovers, just as drink and sex and money beckon to their respective addicts.

In recent months many persons have optimistically argued that the harnessing of atomic energy must (because that energy is so destructive) put an end to men's inveterate habit of making war. Similar arguments have been set forth in the past. Whenever progressive applied science has produced some strikingly more efficient instrument of slaughter, hopes have been voiced, and facts and figures marshalled to prove, that henceforward war would be too expensive in life, suffering and money to be worth waging. Nevertheless wars have still been fought. Methods of defence against the new destructive weapon are devised and yet more efficient instruments of counter-attack are invented. Advances in technology do not abolish the institution of war; they merely modify its manifestations. In the present instance it seems quite possible that there may be no defence against atomic missiles. But this does not necessarily presage the end of warfare. The collective mentality of nations—the mentality which reasonable adults have to adopt, when making important decisions in the field of international politics—is that of a delinquent boy of fourteen, at once

SCIENCE, LIBERTY AND PEACE

cunning and childish, malevolent and silly, maniacally egotistical, touchy and acquisitive, and at the same time ludicrously boastful and vain. When the issues involved are of no great weight, the adults in control of a nation's policy are permitted, by the rules of the curious game they are playing, to behave like adults. But as soon as important economic interests or national prestige is involved, this grown-up Jekyll retires and his place is taken by an adolescent Hyde, whose ethical standards are those of a boy-gangster and whose *Weltanschauung* seems to have been formed by a study of Houston Stewart Chamberlain and the more sanguinary comic strips. And let us remember that this same delinquent boy who, concealed in the middle-aged body of a politician, decrees that millions shall do and suffer the utmost in scientifically organized malice, resides within us all, ready and waiting, whenever some crisis makes us forget our surface rationality and idealism, to come out into the open. To this boy gangster in our midst, the natural reaction to the atom bomb is not an impulse to put an end to war by getting rid of its causes in nationalism, economic rivalry and the craving for power. Rather it is an impulse to make use of the new powers provided by science for the purpose of establishing world dominion for his particular gang. It is a highly significant fact that people love to talk about a war to end war, or a war to preserve democracy; they do not love to talk about peace to end war, or self-governing democracy (which is the polar antithesis of militarism) to preserve democracy. Like the adult, with whom he is associated, the nationalistic boy-gangster is frightened of what atomic power may do to him and his world. Nevertheless he continues to think in terms of gang rivalry and his own supremacy. 'If,' he

SCIENCE, LIBERTY AND PEACE

argues, 'our gang can get its scientists to perfect the rocket and the atom bomb, if it can get its manufacturers to produce enough plutonium and uranium 235, to build enough launching ramps and robot planes and V2's, then all that need be done is to press a few buttons and bang! the war to end war will be over, and I shall be the boss of the whole planet.' Because of the boy-gangster in every Foreign Office, every war department and every private home, we may expect that, in the years immediately ahead of us, all the (technologically speaking) advanced nations will spend vast sums upon armament research and the manufacture of new weapons capable of more indiscriminate destruction at ever greater distances. This research will be secret—an affair of 'Manhattan Projects' and 'Tube Alloys'—and much of the manufacture will be carried on at the bottom of mines and caverns. And at some moment—unless, by a miracle, Jekyll should contrive to get the upper hand—the temptation to press those buttons will become irresistible; the juvenile delinquent in some Ministry for Foreign Affairs will call up his colleague at the Ministry of National Defence and bang! the war to make the world yet safer for delinquency will have begun.

In discussing the possibility of abolishing war, another important point to be remembered is that the preparation for war and sometimes even war itself are things which a highly centralized government finds very useful for its own totalitarian purposes. Thus, peacetime conscription is always justified on the ground that it constitutes an insurance against war, or at least against defeat in war. In actual fact, of course, nations which have adopted peacetime conscription have fought just as many wars as they fought before adopting it, and have suffered just as

SCIENCE, LIBERTY AND PEACE

many defeats. The real, the unavowed reason for peacetime conscription must be sought in the all too natural desire of a powerful, centralized government to regiment and control its subjects by placing them, actually or potentially, under martial law and by arrogating to itself the right, whenever it so desires (as, for example, during an inconvenient strike), to call them to the colours. In these days of atomic weapons, mass armies would seem to have become something of an anachronism. Nevertheless, no country which imposed peacetime conscription in the past shows any inclination to relax its grip upon the masses of its people. Moreover, in countries where peacetime conscription was previously unheard-of there are many high military and civilian officials who advocate the imposition of permanent military servitude upon the masses.

There is also another way in which the preparation for war is useful to the holders of centralized political power. When things go badly at home, when popular discontent becomes inconveniently articulate, it is always possible, in a world where war-making remains an almost sacred habit, to shift the people's attention away from domestic to foreign and military affairs. A flood of xenophobic or imperialistic propaganda is released by the government-controlled instruments of persuasion, a 'strong policy' is adopted toward some foreign power, an appeal for 'national unity' (in other words, unquestioning obedience to the ruling oligarchy) is launched, and at once it becomes unpatriotic for anybody to voice even the most justifiable complaints against mismanagement or oppression. It is difficult to see how any highly centralized government could afford to dispense with militarism and the threat of foreign war. This constitutes yet another

SCIENCE, LIBERTY AND PEACE

argument for the division and dispersal of power, the de-institutionalizing of politics and economics and the substitution, wherever possible, of regional co-operative self-help for centralized mass production and mass distribution, and of regional, co-operative self-government for state intervention and state control.

Finally, we have to consider the part played by militarism in solving those problems of economic and social insecurity, which, as we have seen, are the curse of a technologically progressive society. The great depression of the 1930's was accompanied, in all industrialized countries, by mass unemployment. This fearful social sickness was treated in a variety of ways. Thus, in Great Britain an ambitious housing programme was launched; in the United States the Roosevelt administration resorted to public works, 'pump priming' and restriction of agricultural output with a view to raising prices. These measures were only partially successful. The numbers of the unemployed were reduced, but unemployment was by no means eliminated. Complete success came only when Hitler embarked upon large-scale rearmament. As though by magic, unemployment was banished—first from Germany and, later, as other countries took fright and joined the armament race, throughout the rest of the industrialized world. A cure had been found for the insecurity which is the fruit of scientific and technological progress when it is at the service of centralized finance. But the price of the temporary cure was death and destruction, and the last state of all the nations concerned was incomparably worse than the first. Nevertheless it seems quite possible that wholesale rearmament may, at some future date, again be used to palliate the symptoms of unemployment.

SCIENCE, LIBERTY AND PEACE

It should be remarked that, under the present dispensation, armaments are the only goods that are given away without consideration of costs or profits. Modern war is, among other things, a competition among nations as to which can hand out, free, gratis and for nothing, the largest amount of capital goods in the shortest time. These capital goods are all maleficent and unproductive; but the thought occurs to one that something resembling wartime prosperity might be made permanent if there were more giving away at cost, or even for nothing, and less selling at a profit and paying of interest. Were this to happen, we should have a centralized financing, mass production and mass distribution, combined with a political system approximating state socialism. That this arrangement would in some ways be preferable to the present dispensation seems likely enough. But we must remember that any government enjoying a monopoly of political and economic power is exposed to almost irresistible temptations to tyranny. There has never been a time when too much power did not corrupt its possessors, and there is absolutely no reason to suppose that, in this respect, the future behaviour of human beings will be in any way different from their behaviour in the past and at the present time. The arguments for the limitation and decentralization of power remain valid, even when that power is concentrated in the hands of an oligarchy of socialists—a phrase which is actually a contradiction in terms; for, to quote Mr. Middleton Murry: ‘Socialism by autocracy or oligarchy is not socialism, or anything like it.’ It is just benevolent despotism; and there is nothing in the record of history to justify us in the belief that any benevolent despotism will for long retain its benevolence. The appetite for power grows with every

SCIENCE, LIBERTY AND PEACE

successive satisfaction of that most alluring and pernicious of all the lusts. Against the temptations to abuse power there is no armour except sanctity. But since very few human beings are prepared to pay the price of sanctity and very few saints desire power, mere common sense demands that the amount of power wielded by any individual or organization of individuals should be strictly limited and that the principle of self-government (which is the principle of the division of power, the balancing and compromise of independent forces) should be applied, and applied to the extreme practicable limit, in every field of human activity. This entails the de-institutionalization of many political and economic procedures, which are at present planned from above by the functionaries of private capitalism or the national state. In present circumstances it is most unlikely that this highly desirable process of decentralization and de-institutionalization will be carried out. By the education they have received in schools and, later, at the hands of the writers of advertising copy and political propaganda, the great majority of men and women have been conditioned to believe that progressive institutionalization, controlled by private capitalists, or the state, or both together, is an intrinsically beneficent thing and at the same time an inevitable and quasi-natural development. Those who have a reasoned belief in the current centralist philosophy and those, much more numerous, who take it for granted by an act of implicit faith, cannot be expected to look with anything but suspicion on the ideas of de-institutionalization, self-help and self-government. What is needed is a restatement of the Emersonian doctrine of self-reliance—a restatement, not abstract and general, but fully documented with an account of all the presently available

SCIENCE, LIBERTY AND PEACE

techniques for achieving independence within a localized, co-operative community. These techniques are of many kinds—agricultural techniques designed to supply the basic social unit, the family, with its staple food supply; mechanical techniques for the production of many consumer goods for a local market; financial techniques, such as those of the credit union, by means of which individuals can borrow money without increasing the power of the state or of commercial banks; legal techniques, through which a community can protect itself against the profiteer who speculates in land values, which he has done nothing whatever to increase. At present this documented and practical restatement of an old doctrine is being made by such men as Wilfred Wellock in England, as Ralph Borsodi and the writers who contribute to *Free America* in the United States. In the enormous bellowing chorus of advertisers singing the praises of centralized mass-producing and mass-distributing industry, and of Left-wing propagandists singing the praises of the omnipotent state, these few isolated voices have some difficulty in making themselves heard. If it were not for the fact that, in the past, apparently negligible movements, originating among individuals without any political power, have yet exercised a prodigious influence over mankind, there would be reason for discouragement. But fortunately it is not impossible that the presently tiny piece of decentralist leaven may end by leavening the whole huge lump of contemporary society.

It is not impossible, I repeat; but it must be added that, so long as the nations stick to their ancient habit of war-making, it is highly improbable. For the nature of modern war is such that it cannot be successfully waged by any nation which does not possess a highly developed,

SCIENCE, LIBERTY AND PEACE

not to say hypertrophied, capital-goods industry supplemented by a mass-producing consumer-goods industry capable of rapid expansion and conversion for wartime needs. Furthermore it cannot be waged successfully, except by nations which can mobilize their entire manpower and woman-power in universal military or industrial conscription. But universal conscription is most easily imposed where large numbers of the population are rootless, propertyless and entirely dependent for their livelihood upon the state or upon large-scale private employers. Such persons constitute that dream of every militaristic dictator—a 'fluid labour force,' which can be shifted at will from one place or one unskilled job to another place or job. Again, big centralized corporations and their wage-earning employees can be taxed much more easily and profitably than small-scale farmers working primarily for subsistence and only secondarily for cash, or than independent or co-operative producers of commodities for a localized market. For this reason anything like a popular movement in the direction of decentralization could hardly be tolerated by any government desirous of becoming or remaining a 'great power.' It may be argued that the bomber and the rocket may force all nations to undertake a geographical dispersion of industries; but such dispersion can take place without any real decentralization of political and economic power, any real increase of individual independence from governmental or capitalist control, or any expansion of the present area of voluntary co-operation, self-government and de-institutionalized activity.

'Science' is an abstract word, and when we are trying to think about concrete political and economic problems, it is best to talk concretely, not of science but of the

SCIENCE, LIBERTY AND PEACE

people who work in the various scientific fields, from the fields of uncontaminated theory and disinterested research into basic problems to those of applied science and technology. Assuming that the abolition of war is desirable, we proceed to ask ourselves how scientific workers can help to achieve this end.

1. As individuals or in organized groups, scientific workers can take three kinds of action against war. There is, first, the possibility of negative action in the form of a refusal, on conscientious grounds, to participate in work having as its purpose the killing, torture or enslavement of human beings. Christianity once insisted, and Buddhism still insists, upon the importance of 'right livelihood.' There are certain professions so intrinsically harmful that no individual ought to practise them. In the eyes of medieval Catholic theologians, for example, the profession of a moneylender or of a speculator was beyond the pale: they held that a man could not live by usury and the manipulation of the commodity markets, and still be regarded as a Christian. Similarly, for Buddha and his followers, a man could not be regarded as a Buddhist, if he made his living by the manufacture of arms or intoxicants. Men of science and technologists would do well, as individuals and in their national and international organizations, to consider the problem of right livelihood in its relation to their own contemporary activities. Is it possible to work on the development of instruments of ever more indiscriminate slaughter and to remain—not a good Christian or a good Buddhist; for in scientific and technological circles religion is now out of fashion—but a good human being? Is it possible to go on believing that one is working for the good of mankind, while applying the results of disinterested research

SCIENCE, LIBERTY AND PEACE

in ways which demonstrably increase the power of the ruling capitalist or governmental minority at the expense of personal liberty and local and professional self-government? These and similar questions need to be asked and carefully answered by scientific workers—asked and answered, if possible, on the level of their international organizations. Meanwhile it is to be hoped and perhaps expected that a certain number of individual scientists and technicians will take the negative stand against war and the centralization of power which is war's inevitable accompaniment, by refusing to collaborate in any project whose purpose is the destruction or enslavement of human beings.

2. Negative action is good so far as it goes, but it needs to be supplemented by action of a positive and constructive kind. Such positive action may be classified under two heads: (a) action which takes its start in politics, to end in the field of science: and (b) action which takes its start in science, to end in politics.

(a) Several suggestions have recently been made for the political control, in the interests of humanity, of the activities of scientists and technologists. Thus, in the course of an interesting two-day debate in the House of Lords (May 29 and 30, 1945) Lord Vansittart urged the necessity of subjecting all German laboratories, whether attached to universities or supported by the state or by private industrialists, to strict supervision over a long term of years. Only in this way, he claimed, could the danger of a war of revenge, waged with new 'secret weapons,' be avoided. More realistically, Lord Brabazon proposed that this supervision of scientific developments should not be confined exclusively to the defeated nations—nations whose opportunities for the large-scale manu-

SCIENCE, LIBERTY AND PEACE

facture of new weapons would, for many years at least, be small. His suggestion was that, under the final peace treaties, an international committee of inspection should be constituted, having authority to enter laboratories and factories in any part of the world. In Lord Brabazon's view, the only alternative to such a scheme of international inspection would be an armament race between Britain and the United States on the one hand and the rest of the world on the other. By intensive research the Anglo-Saxon group might hope to obtain the lead in such a race, and so discourage attack by other powers. Lord Brabazon's speech was made before the dropping of the first atomic bomb. As things now stand, the United States and Britain already possess an enormous lead in the post-war armament race. For a few years they may keep that lead. Then other nations (unless, of course, they are previously blown to bits by the present possessors of the bomb, or unless reason, surrender of absolute sovereignty and world government come to replace nationalism) will be supplied by their scientists with the same or even better methods for manufacturing atomic missiles. Meanwhile the desirability of an international inspectorate charged with preserving humanity from the triumphs of science is even greater now than it was before Hiroshima. The existence of an international inspectorate would involve the adoption of another security measure, advocated in the course of the same debate by Lord Strabolgi—namely, the pooling of all scientific discoveries considered by competent experts to be actually or potentially a danger to mankind.

Similar suggestions have been made on the other side of the Atlantic, and it now remains to be seen whether, and to what extent, the United Nations will act

SCIENCE, LIBERTY AND PEACE

upon them. Meanwhile Messrs. Truman, Attlee and King have decided to keep such secrets as their scientists and engineers still possess until 'enforceable safeguards' against their use for destructive purposes can be devised.

What is to be the nature of those 'enforceable safeguards'? As yet, it would seem, nobody has any very clear idea. In principle, the proposals for a pooling of dangerous knowledge and for an international inspectorate are excellent; and, to some, the theory of an 'international police force' seems attractive and even workable. But, alas, from principle to application and from theory to practice the road is long and hard. Two disturbing questions inevitably propound themselves. First, will the various national governments concerned agree to act upon these suggestions? Second, if they do agree, will they and the men of science they employ consent to play the game according to the internationally imposed rules? In attempting to answer these questions one must weigh the power of enlightened self-interest against the power of nationalistic passions and prejudices. Enlightened self-interest will unquestioningly vote for world government, international inspection and the pooling of information. But unfortunately, in some of the most important issues of life, human beings do not act from considerations of enlightened self-interest. If they did, we should now be living in something very like paradise. In the field of international politics, as we have seen, the gravest decisions are always taken, not by reasonable adults but by boy-gangsters. Despite the lessons of Hiroshima and Nagasaki, it is quite possible that some national governments will refuse to allow their laboratories and factories to be inspected—and, of course, the refusal of even one government will entail the general abandonment of the

SCIENCE, LIBERTY AND PEACE

scheme. Alternatively, the principle of international inspection will be accepted; but at first some and then (when suspicion has been aroused) all the governments concerned will conspire with the scientists in their employ to carry on research in caves or forests or mountain fastnesses, where no prying eye can see what they are up to. It may perhaps seem unlikely that workers trained in the methods of science should support their political bosses in machinations so manifestly senseless, as well as immoral. But it is not because men have learned to behave rationally in the laboratory that they can be trusted to behave rationally toward foreigners and unpopular minorities, or even toward their own wives and children. Until a very few years ago the best scientific and technological education available was given in Germany; but most of the persons who received that education not only worked for the Nazi bosses, but believed in their doctrines and were swayed by the nationalistic passions which they so skilfully exploited. The case of Germany is not unique. In all countries nationalistic passions (of the same kind as were manifested in Germany, but at a somewhat lower level of intensity) are almost as common among scientists and technicians as in other classes of society. In spite of their training (perhaps, indeed, owing to the narrowly specialized character of that training, because of it), scientists and technicians are perfectly capable of the most dangerously irrational prejudice, nor are they immune to deceitful propaganda. The same men who reject as superstitious the belief in a transcendent and immanent spiritual Reality beyond and within phenomena, prove by their actions that they find no difficulty in worshipping as a supreme god whichever one of the world's fifty-odd nations they happen to belong to, and

SCIENCE, LIBERTY AND PEACE

in accepting the infallibility of the local Foreign Office and the quasi-divinity of the local political boss. In view of all this we need not be surprised if the plans for an international inspectorate and the pooling of scientific knowledge should fail in practice to produce the good results expected of them.

(b) We must now consider the specifically scientific action which might be taken by men of science and technicians with a view to diminishing the probability of war and so to increasing the sum of human liberty. Such action can only be taken on the plane of applied science. Basic research is essentially disinterested. Men undertake it because, in the words used by the boy Clerk Maxwell, they want to find out 'what's the go' of things—to discover how nature works and how its parts are related within a causal system. What is subsequently done with the results of disinterested research is something which the researcher cannot foresee, and for which he is not responsible. Thus, Clerk Maxwell's own adult curiosity to find out the go of such things as light and magnetism led him to certain conclusions, and these conclusions have since been utilized by technicians for the development of instruments, which are now used, in the main, for the dissemination of maudlin drama, cigarette advertising, bad music and government-sponsored or capitalist-sponsored propaganda. Clerk Maxwell would probably have been horrified by all these uses of the radio, and he is, of course, in no way to blame for them. In practice, it would seem, basic research cannot be planned, except perhaps to the extent of subsidizing inquiry into branches of knowledge which, for whatever reason, appear to have been unduly neglected. If the facilities for research are supplied, men and women with an overpowering desire

SCIENCE, LIBERTY AND PEACE

to find out the go of things will always be forthcoming to make use of them. The planning of scientific activity with a view to achieving certain predetermined political, social and economic ends must begin at the point where the results of disinterested research are applied to the solution of practical problems. Individually and through their professional organizations, scientists and technicians could do a great deal to direct the planning toward humane and reasonable ends.

In theory everyone agreed that applied science was made for man and not man for applied science. In practice great masses of human beings have again and again been sacrificed to applied science. The conflict between science, as it has been applied up to the present, and human interests was clearly stated by Thorstein Veblen in his *Science in the Modern World*. In this essay Veblen distinguishes between what he calls the pragmatic and the scientific point of view. Pragmatically human beings know pretty well what is good for them, and have developed myths and fairy tales, proverbs and popular philosophies, behaviour-patterns and moralities, in order to illustrate and embody their findings about life. The findings of science—especially of science as applied for the benefit of the holders of centralized economic and political power—are frequently in conflict with humanity's pragmatic values, and this conflict has been and still is the source of much unhappiness, frustration and bitterness. The enormous practical importance of the clash between scientific (or rather applied-scientific) values and pragmatic human values is stressed in an editorial which appeared in a recent issue (July 22, 1945) of the leading British scientific journal *Nature*. In maintaining industrial morals 'the central difficulty,' writes the author of

SCIENCE, LIBERTY AND PEACE

this article, 'is essentially the inevitable opposition which develops between the scientific approach to the human problems of production and the political approach of the administrator, trained in the method of accommodation and compromise. The balancing of opinion and the compromise of different points of view, which is the essence of the political process, may be totally at odds with the scientific approach to questions of industrial management. What is required is not the surrender of scientific principles of established accuracy, or the ignoring of accepted fact, but the combination or integration of both the political and scientific approach in a solution which satisfies both the scientific and the psychological or political requirements.'

Let us begin by noting that in any discussion of economic or political problems, the word 'integration' is always a danger signal; for it is always tacitly assumed that the work of integration is carried out by somebody standing above the processes and persons to be integrated. In other words, whenever people call for 'integration' they are always calling for the exercise of centralized governmental power and for yet another extension of the process of institutionalization. But power is always corrupting, and no human being or group of human beings is to be trusted with too much of it for too long. When science is applied in such a way as to create a form of production, which cannot be run efficiently without coming into sharp conflict with fundamental human values, and which therefore continually calls for the intervention of a governmental authority having power to 'integrate' the conflicting persons and points of view, it may be fairly presumed that the application of the results of disinterested research has been, humanly speaking, misguided

SCIENCE, LIBERTY AND PEACE

and undesirable. Up to the present time applied science has not been used mainly or primarily for the benefit of humanity at large, or (to put the matter less abstractly) for the benefit of individual men and women, considered as personalities each one of which is capable, given suitable material and social conditions, of a moral and spiritual development amounting, in some cases, to a total transfiguration; rather man has been used for applied science, for the technicians who enjoy designing more and more complicated gadgets, and for the financial and governmental interests which profit by the centralization of power. If applied science is henceforward to be used for man, technicians and scientists will have to adopt a professional policy, consciously and deliberately designed to serve fundamental human needs and to forward the causes of peace and personal liberty. Such a policy could not be worked out in detail except by an international organization of scientific workers, highly trained in their respective fields, so that each could contribute his or her share of skill or information toward the realization of the common end—namely, the welfare, liberty and peace of the individuals composing the human race. It would be absurd for me to try to anticipate the findings of this hypothetical group of experts; but it is possible, without too much presumption, to indicate in a general way a few of the lines which their discussion would have to follow.

Humanity's primary requirement is a sufficiency of food; but it is primarily by considerations of power that the policies of national governments are at present dictated. The ruling minorities of the world invariably contrive to have enough, and (to judge by the disgusting descriptions of recent diplomatic banquets) more than

enough to eat; consequently they tend to take food for granted and to think first, and at times almost exclusively, in terms of the questions: Who shall bully whom? But the great majority of the men, women and children on this planet are in no position to take food for granted. Their first and often their exclusive concern is the next meal. The question as to who shall bully whom is of hardly more than academic interest to them. They would like, of course, to be left in peace to go their own way; but they know by bitter experience that, under the present dispensation, there will always be a ruling minority to order them about, to bully and badger them in the name of the divine Nation, the omniscient Party, the sacred Principles of this or that political doctrine. They are therefore unable to take much interest in the national and international policies, which are the prime concern of the well-fed power lovers at the top of the social pyramid.

At the San Francisco Conference the only problems discussed were problems of power. The basic problem of mankind—the problem of getting enough to eat—was relegated to an obscure international committee on agriculture. And yet it is surely obvious that if genuine international agreement is ever to be reached and preserved, it must be an agreement with regard to problems which, first, are of vital interest to the great masses of humanity and which, second, are capable of solution without resort to war or the threat of war. The problems of power are primarily the concern of the ruling few, and the nature of power is essentially expansive, so that there is not the least prospect of power problems being solved, when one expanding system collides with another expanding system, except by means of organized, scientific

SCIENCE, LIBERTY AND PEACE

violence or war. But war on the modern scale shatters the thin, precarious crust of civilization and precipitates vast numbers of human beings into an abyss of misery and slow death, of moral apathy or positive and frenzied diabolism. If politicians were sincere in their loudly expressed desire for peace, they would do all they could to by-pass the absolutely insoluble problems of power by concentrating all their attention, during international conferences and diplomatic discussion, on the one great problem which every member of the human race is concerned to solve—the one great problem which not only does not require military violence for its solution, but which, for the world at large, is wholly insoluble so long as the old games of militarism and power politics continue to be played. The first item on the agenda of every meeting between the representatives of the various nations should be: *How are all men, women and children to get enough to eat?*

It is fashionable nowadays to say that Malthus was wrong, because he did not foresee that improved methods of transportation can now guarantee that food surpluses produced in one area shall be quickly and cheaply transferred to another, where there is a shortage. But first of all, modern transportation methods break down whenever the power politicians resort to modern war, and even when the fighting stops they are apt to remain disrupted long enough to guarantee the starvation of millions of persons. And, secondly, no country in which population has outstripped the local food supply can, under present conditions, establish a claim on the surpluses of other countries without paying for them in cash or exports. Great Britain and the other countries in western Europe, which cannot feed their dense populations, have been

SCIENCE, LIBERTY AND PEACE

able, in times of peace, to pay for the food they imported by means of the export of manufactured goods. But industrially backward India and China—countries in which Malthus' nightmare has come true with a vengeance and on the largest scale—produce few manufactured goods, consequently lack the means to buy from underpopulated areas the food they need. But when and if they develop mass-producing industries to the point at which they are able to export enough to pay for the food their rapidly expanding populations require, what will be the effect upon world trade and international politics? Japan had to export manufactured goods in order to pay for the food that could not be produced on the overcrowded home islands. Goods produced by workers with a low standard of living came into competition with goods produced by the better paid workers of the West, and undersold them. The West's retort was political and consisted of the imposition of high tariffs, quotas and embargoes. To these restrictions on her trade Japan's answer was the plan for creating a vast Asiatic empire at the expense of China and of the Western imperialist powers. The result was war. What will happen when India and China are as highly industrialized as pre-war Japan and seek to exchange their low-priced manufactured goods for food, in competition with Western powers, whose standard of living is a great deal higher than theirs? Nobody can foretell the future; but undoubtedly the rapid industrialization of Asia (with equipment, let it be remembered, of the very latest and best post-war design) is pregnant with the most dangerous possibilities.

It is at this point that internationally organized scientists and technicians might contribute greatly to the cause of peace by planning a world-wide campaign, not merely

SCIENCE, LIBERTY AND PEACE

for greater food production, but also (and this is the really important point) for regional self-sufficiency in food production. Greater food production can be obtained relatively easily by the opening up of the earth's vast subarctic regions at present almost completely sterile. Spectacular progress has recently been made in this direction by the agricultural scientists of the Soviet Union; and presumably what can be done in Siberia can also be done in northern Canada. Powerful ice-breakers are already being used to solve the problems of transportation by sea and river; and perhaps commercial submarines, specially equipped for travelling under the ice, may in the future ensure a regular service between Arctic ports and the rest of the world. Any increase of the world's too scanty food supply is to be welcomed. But our rejoicings must be tempered by two considerations. First, the surpluses of food produced by the still hypothetical Arctic granaries of Siberia and Canada will have to be transferred by ship, plane and rail to the overpopulated areas of the world. This means that no supplies would be available in war-time. Second, possession of food-producing Arctic areas constitutes a natural monopoly, and this natural monopoly will not, as in the past, be in the hands of politically weak nations, such as Argentina and Australia, but will be controlled by the two great power systems of the post-war period—the Russian power system and the Anglo-American power system. That their monopolies of food surpluses will be used as weapons in the game of power politics seems more than probable. 'Lead us not into temptation.' The opening up of the Arctic will be undoubtedly a great good. But it will also be a great temptation for the power politicians—a temptation to exploit a natural monopoly in order to gain influence and

SCIENCE, LIBERTY AND PEACE

finally control over hitherto independent countries, in which population has outstripped the food supply.

It would seem, then, that any scientific and technological campaign aimed at the fostering of international peace and political and personal liberty must, if it is to succeed, increase the total planetary food supply by increasing the various regional supplies to the point of self-sufficiency. Recent history makes it abundantly clear that nations, as at present constituted, are quite unfit to have extensive commercial dealings with one another. International trade has always, hitherto, gone hand in hand with war, imperialism and the ruthless exploitation of industrially backward peoples by the highly industrialized powers. Hence the desirability of reducing international trade to a minimum, until such time as nationalist passions lose their intensity and it becomes possible to establish some form of world government. As a first step in this direction, scientific and technical means must be found for making it possible for even the most densely populated countries to feed their inhabitants. The improvement of existing food plants and domestic animals; the acclimatization in hitherto inhospitable regions of plants that have proved useful elsewhere; the reduction of the present enormous waste of food by the improvement of insect controls and the multiplication of refrigerating units; the more systematic exploitation of seas and lakes as sources of food; the development of entirely new foods, such as edible yeasts; the synthesizing of sugars as a food for such edible yeasts; the synthesizing of chlorophyll so as to make direct use of solar energy in food production—these are a few of the lines along which important advances might be made in a relatively short time.

SCIENCE, LIBERTY AND PEACE

Hardly less important than regional self-sufficiency in food is self-sufficiency in power for industry, agriculture and transportation. One of the contributing causes of recent wars has been international competition for the world's strictly localized sources of petroleum, and the current jockeying for position in the Middle East, where all the surviving great powers have staked out claims to Persian, Mesopotamian and Arabian oil, bodes ill for the future. Organized science could diminish these temptations to armed conflict by finding means for providing all countries, whatever their natural resources, with a sufficiency of power. Water power has already been pretty well exploited. Besides, over large areas of the earth's surface there are no mountains and therefore no sources of hydro-electric power. But across the plains where water stands almost still, the air often moves in strong and regular currents. Small windmills have been turning for centuries; but the use of large-scale wind turbines is still, strangely enough, only in the experimental stage. Until recently the direct use of solar power has been impracticable, owing to the technical difficulty of constructing suitable reflectors. A few months ago, however, it was announced that Russian engineers had developed a cheap and simple method for constructing paraboloid mirrors of large size, capable of producing superheated steam and even of melting iron. This discovery could be made to contribute very greatly to the decentralization of production and population and the creation of a new type of agrarian society making use of cheap and inexhaustible power for the benefit of individual small-holders or self-governing, co-operative groups. For the peoples of such tropical countries as India and Africa the new device for directly harnessing solar power should be of enormous

SCIENCE, LIBERTY AND PEACE

and enduring benefit—unless, of course, those at present possessing economic and political power should choose to build mass-producing factories around enormous mirrors, thus perverting the invention to their own centralistic purposes, instead of encouraging its small-scale use for the benefit of individuals and village communities. The technicians of solar power will be confronted with a clear-cut choice. They can work either for the completer enslavement of the industrially backward peoples of the tropics, or for their progressive liberation from the twin curses of poverty and servitude to political and economic bosses.

The storage of the potentialities of power is almost as important as the production of power. One of the most urgent tasks before applied science is the development of some portable source of power to replace petroleum—a most undesirable fuel from the political point of view, since deposits of it are rare and unevenly distributed over the earth's surface, thus constituting natural monopolies which, when in the hands of strong nations, are used to increase their strength at the expense of their neighbours and, when possessed by weak ones, are coveted by the strong and constitute almost irresistible temptations to imperialism and war. From the political and human point of view, the most desirable substitute for petroleum would be an efficient battery for storing the electric power produced by water, wind or the sun. Further research into atomic structure may perhaps suggest new methods for the construction of such a battery.

Meanwhile it is possible that means may be devised, within the next few years, for applying atomic energy to the purposes of peace, as it is now being applied to those of war. Would not this technological development solve

SCIENCE, LIBERTY AND PEACE

the whole problem of power for industry and transportation? The answer to this question may turn out to be simultaneously affirmative and negative. The problems of power may indeed be solved—but solved in the wrong way, by which I mean in a way favourable to centralization and the ruling minority, not for the benefit of individuals and co-operative, self-governing groups. If the raw material of atomic energy must be sought in radioactive deposits, occurring sporadically, here and there, over the earth's surface, then we have natural monopoly with all its undesirable political consequences, all its temptations to power politics, war, imperialistic aggression and exploitation. But of course it is always possible that other methods of releasing atomic energy may be discovered—methods that will not involve the use of uranium. In this case there will be no natural monopoly. But the process of releasing atomic energy will always be a very difficult and complicated affair, to be accomplished only on the largest scale and in the most elaborately equipped factories. Furthermore, whatever political agreements may be made, the fact that atomic energy possesses unique destructive potentialities will always constitute a temptation to the boy-gangster who lurks within every patriotic nationalist. And even if a world government should be set up within a fairly short space of time, this will not necessarily guarantee peace. The Pax Romana was a very uneasy affair, troubled at almost every imperial death by civil strife over the question of succession. So long as the lust for power persists as a human trait—and in persons of a certain kind of physique and temperament this lust is overmasteringly strong—no political arrangement, however well contrived, can guarantee peace. For such men the instruments of violence

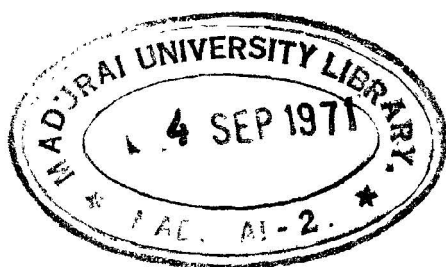
SCIENCE, LIBERTY AND PEACE

are as fearfully tempting as are, to others, the bodies of women. Of all instruments of violence, those powered by atomic energy are the most decisively destructive; and for power lovers, even under a system of world government, the temptation to resort to these all too simple and effective means for gratifying their lust will be great indeed. In view of all this, we must conclude that atomic energy is, and for a long time is likely to remain, a source of industrial power that is, politically and humanly speaking, in the highest degree undesirable.

It is not necessary in this place, nor am I competent, to enter any further into the hypothetical policy of internationally organized science. If that policy is to make a real contribution toward the maintenance of peace and the spread of political and personal liberty, it must be patterned throughout along the decentralist lines laid down in the preceding discussion of the two basic problems of food and power. Will scientists and technicians collaborate to formulate and pursue some such policy as that which has been adumbrated here? Or will they permit themselves, as they have done only too often in the past, to become the conscious or unconscious instruments of militarists, imperialists and a ruling oligarchy of capitalistic or governmental bosses? Time alone will show. Meanwhile, it is to be hoped that all concerned will carefully consider a suggestion made by Dr. Gene Weltfish in the September, 1945, issue of the *Scientific Monthly*. Before embarking upon practice, all physicians swear a professional oath—the oath of Hippocrates—that they will not take improper advantage of their position, but always remember their responsibilities toward suffering humanity. Technicians and scientists, proposes Dr. Weltfish, should take a similar oath in some such

SCIENCE, LIBERTY AND PEACE

words as the following: 'I pledge myself that I will use my knowledge for the good of humanity and against the destructive forces of the world and the ruthless intent of men; and that I will work together with my fellow scientists of whatever nation, creed or colour for these our common ends.'



THE WORKS OF ALDOUS HUXLEY

Novels

CROME YELLOW	1921
ANTIC HAY	1923
THOSE BARREN LEAVES	1925
POINT COUNTER POINT	1928
BRAVE NEW WORLD	1932
EYELESS IN GAZA	1936
AFTER MANY A SUMMER	1939
TIME MUST HAVE A STOP	1945
APE AND ESSENCE	1949
THE GENIUS AND THE GODDESS	1955
ISLAND	1962

Short Stories

LIMBO	1920
MORTAL COILS	1922
LITTLE MEXICAN	1924
TWO OR THREE GRACES	1926
BRIEF CANDLES	1930
COLLECTED SHORT STORIES	1957

Biography

GREY EMINENCE	1941
THE DEVILS OF LOUDUN	1952

General

ON THE MARGIN	1923
ALONG THE ROAD	1925
PROPER STUDIES	1927
JESTING PILATE	1928
DO WHAT YOU WILL	1929
MUSIC AT NIGHT	1931
TEXTS AND PRETEXTS	1932
BEYOND THE MEXIQUE BAY	1934
THE OLIVE TREE	1936
ENDS AND MEANS	1937
THE ART OF SEEING	1943
THE PERENNIAL PHILOSOPHY	1946
SCIENCE, LIBERTY AND PEACE	1947
THEMES AND VARIATIONS	1950
THE DOORS OF PERCEPTION	1954
<i>and</i> HEAVEN AND HELL	1956
ADONIS AND THE ALPHABET	1956
BRAVE NEW WORLD REVISITED	1959
LITERATURE AND SCIENCE	1963

Aldous Huxley was born in 1894, the third son of Leonard Huxley (the biographer and editor of the *Cornhill Magazine*) and grandson of T. H. Huxley. His mother, a niece of Matthew Arnold and sister of Mrs. Humphry Ward, died when he was fourteen. From a preparatory school (described in *Eyeless in Gaza*) he went on to Eton, which he left at seventeen owing to serious eye-trouble which left him nearly blind. One eye recovered sufficiently for him to go up to Balliol in 1913, but he had to abandon his hope of becoming a doctor and was debarred from military service in 1914. He took a first in English in 1916 and spent the rest of the war working on the land (with the Morrells at Garsington), at the War Office and teaching at Eton. In 1919 he married Maria Nys, a Belgian (by whom he had one son); the same year he joined *The Athenæum* under Middleton Murry. He now wrote a great deal of journalism, including biographical and architectural articles and reviews of fiction, drama, music and art. Having already published three books of verse from 1916 onwards, he began with *Limbo* and *Crome Yellow* the series of stories and novels which combined dazzling intellectual dialogue and a surface cynicism with a ground base of clear moral convictions, and exerted a strong emancipating influence.

In the '20s Huxley lived mostly in Italy, where he saw much of D. H. Lawrence (portrayed, together with Katherine Mansfield, Murry and himself, in *Point Counter Point*); in the '30s his home was at Sanary, near Toulon. To this period belonged *Brave New World*—a vision of the future in which scientific control has produced an utterly dehumanized totalitarian society yet a perfectly contented population; also *Ends and Means*, a philosophical work in which he sought a way of securing the benefits of social planning while avoiding authoritarianism. In the mid '30s he was deeply concerned with the Peace Pledge Union, but in 1937 the state of his eyes led him to move to California. There he became convinced of the value of mystical experience, the theme of *The Perennial Philosophy*. In *Doors of Perception* and *Heaven and Hell* he described the quasi-mystical effects of L.S.D.

After the death of his first wife in 1955 Huxley married Laura Archera, in 1956. In 1961 their home was totally destroyed by fire. Little survived apart from the manuscript of *Island*, his last novel, in which he presents an ideal society which repudiates the striving ethos of the West for a more cheerful, balanced quietism, and confines technological advance to eugenics and agriculture.

Aldous Huxley died in November 1963.